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THE INDEPENDENT TELPHONE CONVENTION.

In another column of this issue will be found a dispatch from the Chicago correspondent of THE ELECTRICAL WORLD, giving an account of the first day's session of the convention of independent telephone companies, now in progress in that city. The object of the meeting is to devise ways and means for concerted defensive action in case the American Bell Telephone Company should adopt methods likely to interfere with the business of the independent telephone exchanges. The probable outcome of the convention is hard to foretell at this time, but if it results in the unification of the diverse independent interests it cannot fail to be of great benefit to the rapidly increasing business of telephony.

Already the investment in independent telephone exchanges has reached a large sum, and bids fair, should no adverse decision be reached in the coming trial of strength on the question of infringement of the Berliner patent, to grow to enormous proportions. Another result already attained by the establishment of independent exchanges has been a decided lowering of telephone tolls in the communities where they have been put in operation, and a general extension of interurban lines, which has immensely facilitated business in many parts of the country.

That this great industry, which so vitally affects the convenience of a very large part of the public, should suffer any curtailment of its functions by an adverse legal decision would be greatly deprecated. There is no doubt that the sympathies of the public are entirely with the independent companies, and it is equally certain that these latter will have a strong case when the infringement proceedings are begun, if they ever are. Union on their part will permit them to present a much stronger front to the assaults of their adversary.

The status of these independent exchanges, so far as the patent situation is concerned, is precisely the same as it was before the recent decision in the Government suit for annulment of the Berliner patent. The actual merits of the patent have not been tested in a suit against its alleged infringers. It is stated by high legal authority that such a suit cannot be successfully maintained. At any rate, if it is, it will take a long time, during which the independent companies will continue growing stronger. The whole situation is deeply interesting, and it is to be hoped that no differences will mar the harmony of the present convention, in the interests not only of the independent exchanges, but in those of the public and the art of telephony as well.

AN EPOCH IN RAILROADING.

On Monday, May 24, the new third-rail system between New Britain and Hartford, Conn., described in THE ELECTRICAL WORLD of May 15, was opened to the public for business. There were no formal ceremonies, but it is likely that this date will be long remembered as that on which electricity first replaced the steam locomotive for regular trunk line railway service.

Almost exactly ten years ago the first important street railway electrical equipment was put in service in Richhmond, Va. There were few then who felt sure of the success of that ambitious attempt to do away with the familiar mule, and none who would have

dared to prophesy this more ambitious attempt to replace the steam locomotive in ten years. Yet, to-day, the success of the Connecticut line is looked upon as a matter of course, the wonder being that it was not sooner operated by electricity rather than that it is so operated now.

The ten years between the opening of the two roads have seen the growth of an enormous industry, and the evolution of a highly perfected type of machinery. In them the electrical industries have made wonderful strides forward in both completeness and importance. Invention, however, has been confined to details in this field. The railway motor of 1897 is not electrically very different from that of 1887, though marvelously better mechanically. There has been practically no advance in methods of conduction, and the dynamo is only a trifle more efficient, while mechanically stronger and simpler.

President Clark, in a newspaper interview concerning the section of railway just opened, made some very conservative remarks concerning the future of electric traction under steam railroad conditions. He said: "That the locomotive will follow the old stage coach and be relegated to the scrap heap is by no means determined, but that the motor car will soon supersede the locomotive on suburban commutation routes seems probable."

He might have gone further and said that the disappearance of the steam locomotive from crowded suburban lines is not only probable but necessary. As soon as the railroad companies are fully aware of the immense superiority of electric propulsion for this class of trains its installation will become merely a question of ability to obtain the necessary machinery. The electrical profession owes a debt of gratitude to President Clark for his courageous action in blazing the way for the motor on suburban passenger lines.

The epoch-marking significance of the Connecticut road cannot be overestimated. Its assured success will mean the immediate equipment of a great number of systems of short line roads now inadequately operated by steam locomotives. It is not to be assumed that this line will be the prototype of succeeding installalations, for its equipment is obviously crude and even experimental, but it will certainly demonstrate in an unmistakable fashion the enormous advantages of electricity over steam for its class of work, and thus perform a pioneer service of incalculable benefit to electricians, railroad companies, and the people at large.

AN IMPORTANT PRECEDENT.

In the Supreme Court of the State of Pennsylvania Justice Williams has just rendered a decision and opinion concerning the speed of electric street cars, which is of importance as a precedent of interest to all street railway companies.

The case was one for damages brought by the parents of a child who had been injured by a car of the Electric Traction Company in Philadelphia. The child was playing upon the sidewalk and suddenly ran out into the street, where she was knocked down and injured by the car. The evidence showed that the car was stopped almost within its own length, with such violence, indeed, as to make a noise which attracted people a block away to the scene.

The principal evidence related to the speed of the car at the time of the accident. It appeared that this was high, but that the car was well under the control of the motorman. Justice Williams, in rendering his opinion on this point, made a statement which is luminous with good sense. He said: "We are not prepared to lay down any rule in regard to the rate of speed at which an electric car may be run between crossings, nor to say that the mere fact that the defendant's car was moving faster than usual at the time the plaintiff ran in front of it would be, in the language just quoted from the charge, 'sufficient to justify' the jury in finding the defendant guilty of negligence. All that can be safely said upon this subject is that the car must be kept well in hand, and that the speed must not be so great as to make this impossible, or to endanger the safety of the public using the streets with responsible care. But these passenger railways are created to facilitate the movements of the general public and to furnish rapid transit for citizens from their homes to the business centre of the city. They are practically indispensable in all great cities. The same rules as to speed that may be applied to ordinary vehicles propelled by horses are not applicable to street cars. They move upon a track from which they cannot turn, which is plainly visible, and which is prepared with a view to the rapid movement of cars upon it. The cars can be seen and heard for considerable distances, and are required to warn persons who may be upon their tracks of their approach. The purpose of their owners and the demand of the public are that the greatest rate of speed consistent with the safety of other persons using the street or highway shall be maintained; and we are unable to say that any rate of speed that does not transcend these limits is negligence, or should be submitted to the jury as 'sufficient to justify' a verdict against the railway company."

This is a recognition of the rights of street railways of the greatest value. It contains a definition of the allowable speed of cars which forms a precedent of vital importance.

TROLLEY CARS ON THE BROOKLYN BRIDGE.

The recent legislation permitting the operation of surface cars on the Brooklyn Bridge opens the way to a very desirable change in the methods of traction now in vogue upon that structure. With the growth of passenger traffic between the two cities the crowding of the present bridge cable cars has increased until the rush of the people at the busy hours is not only exceedingly unpleasant but positively dangerous. The limit of their safe carrying capacity was reached some years ago, and at the present time many persons are resorting to the ferries in preference to using the bridge.

As soon as the surface cars are given the right of way on the bridge these conditions will be materially altered. The load of passengers will be taken on, one or two at a time, at points distributed along the routes of the various lines, thus avoiding the crowding at the terminals and doing away with the wild rushes for the cars that are now a feature of bridge transit. It should also be possible, with a well-ordered system of schedules and switches, to carry more seated passengers than the present cars can provide for and materially reduce the discomforts of crossing the bridge.

The plans recommended by the three engineers commissioned to report upon the matter are feasible and practical to a great degree. They provide means for quickly discharging and taking on passengers at the New York terminus in a very simple and sensible way, while their plans do not contemplate the stoppage of the present cable railway. The bridge is by no means worked to the limit of its carrying capacity, and the new plans would permit the easy doubling of the number of passengers transported by the present system. The public of Greater New York is to be congratulated on the prospect of enlarged accommodations on the bridge, while the extension of the surface lines of Brooklyn to the New York side cannot fail to prove highly profitable to them.

Convention of Independent Telephone Companies.

(*Special Telegram from* THE ELECTRICAL WORLD'S *Correspondent.*)

CHICAGO, MAY 27, 1897.

Ten days ago, shortly after the announcement of the decision in the Berliner case, a call was sent to the various independent telephone exchanges throughout the United States, inviting them to send representatives to a convention to be held in Chicago, May 27, 28 and 29, where a plan of joint resistance to any aggressions of the American Bell Telephone Company could be devised, and measures taken to defeat any move on the part of that corporation likely to prove to the disadvantage of the independent telephone exchanges. The letter calling the convention was signed by Mr. James E. Keelyn, and, among other things, said that it was considered desirable "that the operating exchanges should get together in representative form, determine upon a proper policy to follow and act in unison, and thus create an organization of a national character which will tend to the mutual advantage of all, not only upon this Berliner patent question, but upon all general matters affecting the independent telephone companies."

The response to this call was prompt and gratifying. When the meeting was called to order this morning, at the office of Mr. Keelyn, there were found to be representatives present from nearly every State in the Union. Mr. Keelyn was chosen temporary chairman and opened the convention with one of his characteristic speeches, welcoming the visitors and briefly outlining the policy of the meeting and the proposed scope of its work.

After addresses by others present, a committee of ten was appointed by the chairman to indicate the work of the organization and to select permanent officers, the action of the committee to be subsequently submitted to the convention for approval. The following were appointed on this committee: Messrs. Thomas H. Marshall, Keithsburg, Ill., chairman; George W. Beers, Fort Wayne, Ind.; H. C. Young, Columbia, Pa.; J. A. Leaks, Illinois; S. Stone, Indiana; W. S. Gilbert, Michigan; L. D. Robinson, Iowa; C. Truitt, Missouri; J. Burke, Illinois; J. A. Slade, Iowa.

After other business the convention adjourned to meet again at 3 o'clock at the Palmer House.

The committee of ten above mentioned had a protracted meeting in the parlors of the Palmer House directly after the adjournment of the morning session, and at the afternoon session Chairman Marshall reported that it was the sense of the committee that Mr. Keelyn should be made president of the association, and he was unanimously so elected by the convention.

Mr. Marshall then reported that a committee composed of two from each State had been selected by his committee to form a permanent Executive Committee to look after interests of the association and independent telephone interests in general in their respective States. This committee, so far as decided upon, is as follows: Messrs. W. Hayes Laird, Minneapolis, Minn.; L. C. Fetcham, Palestine, Tex.; L. C. Baker, Beaumont, Tex.; K. D. Lebby, Charleston, S. C.; J. H. Twitchell, Spartansburg, S. C.; W. Newton Smith, Tarboro, N. C.; M. Brown, Montpelier, Vt.; G. H. Almond, Montpelier, Vt.; W. H. Gilbert, East Saginaw, Mich.; D. C. McVeichy, Ishpeming, Mich.; M. Slade, Oscaloosa, Ia.; Judge Stevens, Boone, Ia.; W. A. Harper, Madison, Wis.; H. E. Ralston, Marysville, Mo.; E. C. Baker, Cameron, Mo.; W. B. Seaton, Ashland, Ky.; H. K. Cole, Owensboro, Ky.; H. E. Mathews, Huntington, W. Va.; J. M. Payne, Charleston, W. Va.; W. P. Roberts, Lynchburg, Va.; S. A. Duval, Richmond, Va.; C. E. Funk, Westminster, Md.; Clarence Hodson, Baltimore, Md.; W. H. Rankin, Elizabeth, N. J.; D. C. Dow, Cobleskill, N. Y.; I. A. Evans, Rome, N. Y.; Mr. Crane, Yazoo City, Miss.; Hon. J. N. Thomas, Chillicothe, Ohio; C. H. Critchfield, Mt. Vernon, Ohio; H. C. Young, Columbia, Pa.; C. R. Savidge, Sunbury, Pa.; J. L. Stone, Rushville, Ind.; Dr. J. A. Lumpkin, Mattoon, Ill.; J. A. Marshall, Keithsburg, Ill.

Other business of less importance was then transacted, and several sub-committees were appointed, with instructions to report later to the convention. An adjournment was then taken until Friday morning. After the adjournment Mr. Keelyn said that the good feeling and unity of purpose which prevailed at the two meetings pointed toward the accomplishment of a large amount of useful business in the sessions that were to follow. He added that the object of the convention, briefly stated, was to so amalgamate the various independent telephone companies throughout the United States as to present a bold and effective front to their common enemy, the American Bell Telephone Company; to adopt a definite policy regarding the patent situation in general; to establish, if possible, a broad and comprehensive scheme for the interconnection of various towns by toll lines; and to adopt a uniform character of workmanship and construction on such lines, in order to bring about the most advantageous results in long-distance work. The feeling among those present, he added, showed a strong confidence that this would be the most prosperous year in the history of the independent telephone movement. Mr. Keelyn concluded by saying that it was his hope that all petty jealousies will be put aside, and that as regards the new association, there may be that unanimity of purpose which alone can bring success.

A New Effect of Magnetism on Light.*

BY PROF. DR. KALISCHER.

Since Faraday's great discovery of the electromagnetic rotation of the plane of polarization of light many physicists have made investigations, with more or less success, for the purpose of discovering further relations between light and magnetism. After Faraday had astonished the world, in 1845, with this discovery, he paid constant attention to it, and Bence Jones tells us, in his "Life and Letters of Faraday," that his last experimental research was an investigation on the relations between light and magnetism. At the beginning of the year 1862 a spectral apparatus by Steinheil came into Faraday's hands, and at the end of the next January he made investigations with the view of ascertaining whether the spectra of the chlorides of sodium, barium, strontium and lithium, would suffer any changes when these salts were heated in a flame between the poles of a powerful electromagnet. No matter how the experiments were varied the result always remained a completely negative one.

Where Faraday failed Dr. Zeeman, of Amsterdam, succeeded, by means of the improved facilities at the disposal of modern science. Dr. Zeeman conducted his experiments at the physical laboratory of Leyden, and arranged them in exactly the same way as did Faraday. Between the poles of a Ruhmkorff electromagnet there was placed a hot flame of illuminating gas and oxygen. Into this flame was brought a piece of asbestos saturated with chloride of sodium solution, and the light of the flame was then analyzed with a Rowland grating. The result was that the two D lines appeared broader as soon as the magnet was excited. A Bunsen flame is sufficient for the purpose of producing this effect, but not to such a marked degree as a flame of illuminating gas and oxygen, which is much hotter. In the latter case the lines grow from three to four times their original width. The characteristic line for lithium is likewise affected.

In order to meet the objection that this widening of the spectral lines is solely a consequence of a known change in the shape of a flame caused by the influence of magnetism, thereby causing a change in the temperature and intensity of the incandescent metal vapor, Dr Zeeman did not satisfy himself with the investigation of the spectrum of emission, but also investigated the spectrum of absorption. For this purpose he strongly heated sodium in an unglazed porcelain tube, whose inner diameter was 1 cm and whose ends were closed by plane parallel glass plates. The tube was mounted horizontally between the poles and vertical to the magnetic lines of force, and, in order to avoid variations in temperature and intensity, the tube was rotated around its axis, thereby obtaining a uniform width of the lines. Now if the light of an arc lamp is sent through the tube the D lines are seen in the absorption-spectrum and grow broader as soon as the magnet is excited. According to this a change in the vibration period of sodium light in the magnetic field seems to take place.

This discovery is just at present of great scientific interest. According to all indications our theoretical conceptions of electricity and magnetism are now at a crisis, because there is more and more an inclination to return to the certainly essentially modified "Material Theory" caused by facts which are otherwise inexplicable. The material theory found expression about 100 years ago, for instance, in the hypothesis of fluids. In this direction are also the essays of Wiechert, Reiff and others. Electrical and magnetical phenomena of all descriptions are, according to this theory, not solely based on the ether, but depend also on the material atoms,

* *Elektrotechnische, Zeitschrift*, April 15, 1897.

which are thought to be capable of taking electrical charges, just as, at present, is thought to be the case in the phenomena of electrolysis. According to this, electricity is, to use Helmholtz's expression, "atomistically built," and the theory of dispersion, which has filled a chasm in the magnetic theory of light, is based on the acceptance of elemental charges of the atoms, that is the "ions" or "electrones" as the new term defines them. The opinions of G. J. Stoney on the cause of the double lines of spectra, expressed as early as 1891, relate thereto.

Quite in the same direction and spirit are the investigations of Lorentz, made since 1892, who explains all electrical phenomena by the grouping and motion of the electrones, and who declares the undulations of light to be vibrations of the "ions." It is very significant for the acceptance of this theory that after Zeeman informed Lorentz of his discovery Lorentz predicted phenomena based on this theory, which later on were observed precisely as predicted.

Lorentz announced that a spectral line made broader by magnetic force would be right circularly polarized on one edge and left circularly on the other edge if the flame is looked at in the direction of the magnetic lines of force. If, on the contrary, the flame is looked at vertically to the lines of force then the polarization would be found to be linear. Subsequent experiments fully verified these predictions. According to this the existence of electrones in the flame can hardly be doubted and consequently the relation $e \div m$ between the electro-magnetically measured charge e and the mass m of the electrone can be calculated from the amount of the expansion of the spectral line. Zeeman finds this relation by a very crude measurement of the expansion to be of the order 10^7. The change in the duration of the undulation is estimated to be $\frac{1}{40000}$ with a field strength of 10^4 units (C. G. S.).

To be historically just it must be mentioned here that Fivez observed as early as 1895* by the use of an oxy-hydrogen flame an expansion of the D lines, the green thallium line, and the red potassium and lithium lines. It seems, however, that his experiments were not free from disturbing elements, so that his results cannot be recognized as positive ones.

Mr. Oliver Lodge reviews the discovery of Zeeman in the "Electrician" of February 26, and adds the following views for the purpose of further explaining the discovery:

Suppose that there is, besides the plain oscillating motion, a rotary motion, in the same manner as in the pendulum experiment of Foucault; then the path traveled does not change alone, the duration of oscillation or duration of rotation changes accordingly. There will be, outside of the original or possible motions, by this superposition a number of motions of shorter and another number of relatively longer period. If we have the means to analyze all these motions and to classify them according to the number of their periods—and such means are possessed in the diffraction grading of the prism—then we will see the original kind of motion in the form of a spectral line of distinct width, as well as the expansion of the line caused by the rotating motion which is supposed to be there in addition to the plain oscillating motion.

The mathematical treatment of these phenomena in the sense of the theory of Lorentz is, according to Lodge, as follows:

If an electrical charge, e, moves with the velocity v through a magnetic field of the density H, then the force $e\ v\ H$ is exerted thereon perpendicular to its motion and perpendicular to the lines of force. This force causes, according to the direction of the motion, a deflection to the right or to the left, as is, for instance, the case with a conductor carrying current in a magnetic field. This force cannot exert any influence on the motion of the electrified atom in the direction of the lines of force. Suppose we take, accordingly, the direction of the magnetic lines of force as the Z axis, then the effect to be considered here takes place in the plane $X\ Y$. As long as we have to deal with an uninterrupted simple harmonic motion, perhaps the motion of a material atom, m, which is subject to the elastic force k, then the same is characterized by the equations:

$$m\frac{d^2x}{dt^2} + kx = 0.$$

and

$$m\frac{d^2y}{dt^2} + ky = 0.$$

and the period of the motion is $2\pi\sqrt{\frac{m}{k}}$.

If this atom now receives a charge e and moves in the field H parallel to Z with a velocity whose components are

$$\frac{dx}{dt}\ \frac{dy}{dt}\ \frac{dz}{dt}$$

then a new force is exerted on the same, whose X component is $e\ H\frac{dy}{dt}$ and whose Y component is $e\ H\frac{dx}{dt}$.

Accordingly the above quotations give

$$m\frac{d^2x}{dt^2} + kx = e\ H\ \frac{dy}{dt}$$

and

$$m\frac{d^2y}{dt^2} + ky = e\ H\ \frac{dx}{dt}.$$

The new period of oscillation is given by $\frac{2\pi}{\sqrt{\frac{k}{m} + \left(\frac{e}{2}\frac{H}{m}\right)^2}}$ and accordingly the change of the number of periods to be observed is $\frac{e\ H}{4\pi m}$.

Lodge found the effect not quite as large as Zeeman, but he could otherwise fully corroborate the observations of the latter.

* *Bull. Ac. Belg.*, Tome 3, No. 9, p. 381.

Annual Meeting of the New York Electrical Society.

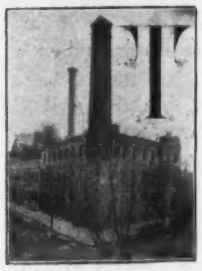
The New York Electrical Society held its annual meeting on Thursday, May 20. The officers elected were: President, Dr. M. I. Pupin; vice-presidents, Gano S. Dunn, Max Osterberg, W. W. Ker, A. L. Riker, Willard E. Case, and H. B. Coho; secretary, George H. Guy; treasurer, Henry A. Sinclair. The society has now 397 members. The president read a letter from the treasurer, in which it was stated that a large number of members had failed to pay their dues. The president urgently requested that these arrears should be remitted forthwith, as the society, while in good financial condition, has plans for extended work next season, the carrying out of which will be impossible without proper funds. After the disposal of the business part of the meeting, Mr. H. Barringer Cox lectured on "The Direct Conversion of Heat Into Electricity," showing the present conditions of the practical relations between heat and electricity in regard to the direct conversion of the energy of fuel into current.

Following the meeting, which has attracted so much attention, at which Mr. Case experimented with his carbon-consuming cell, Mr. H. Barringer Cox, who for many years has been working on the development of thermopiles, gave a very interesting lecture, which he illustrated with three of his thermo-electric generators, using gas flame as the source of heat. These generators consist of a number of thermo-electric couples of ingenious construction, grouped circularly around the flame, in which hangs a deflector, or series of baffle plates. The elements are encased in fire-resisting clay, backed up by a metal case, which forms the water jacket. From this small contrivance, which is about half the size of a silk hat, sufficient output is obtained upon the consumption of two and one-half feet of gas per hour to run a small ordinary fan motor, or to operate such devices as electro-medical circuits, telegraph keys, X-ray apparatus, gongs and other devices. There was an animated discussion, which was participated in by Dr. Emery, Dr. Crocker, Dr. Pupin, and Messrs. Mailloux, C. S. Bradley, Sachs, Ward-Leonard, Leib and others. Mr. Gano S. Dunn made the readings in testing the operation of the thermopiles. There was a brisk dispute as to what the theoretical and the actual output of such devices ought to be.

What's the Matter with the Lightning Bugs?

Electric lighting in Silverton, Col., is evidently not conducted in a very satisfactory manner, judging from the following beautiful exhibition of refined sarcasm, displayed by the local paper: "The city before making a new contract with the electric light company, should consider the advantage of substituting arc lights for the present antiquated lightning bugs."

Enlargement of One of the Central Stations of the Municipal Electric Light Company, Brooklyn, New York.



THE Municipal Electric Light Company, of 208 Broadway, Brooklyn, N. Y., began business in the Spring of 1884 with a single station situated on the corner of Penn Street and Broadway, Brooklyn. Its operations were at this time confined to arc lighting, and toward the close of the same year its business was limited to the supply of 150 2000 candle-power arc lamps.

In 1888 it extended its service to incandescent lighting, employing for this purpose the Thomson-Houston alternating system.

In 1889 it added a new lighting station, situated at the corner of Rodney and Ainslie Streets, which station has continued to be used in conjunction with the Penn Street station up to the present time. The growth of the company's business necessitated the enlargement of the Rodney Street station late in 1896. Inasmuch as this station contains some of the latest improvements in electrical engineering, we believe that the following data will prove of interest to our readers.

The entire district operated by the Municipal Electric Light Company will be understood from an examination of the accompanying map. As will be seen, this district embraces most of the Greenpoint promontory, and takes in an extensive manufacturing and business region.

The company's new station presents a handsome external appearance, as will be seen from the initial cut, taken from a photograph. Two stacks are seen, the original brick stack, and the new one of steel. The two cooling towers placed on the roof to the left of the steel stack are provided for condensing exhaust steam from the boilers.

The building is a three-story brick structure. The testing, draughting and stock room, together with the meter-testing and arc-light testing rooms, are situated on the third floor of the building. The generators and switchboard are situated on the second floor, while the engines are on the ground floor. A separate portion of the building is assigned to the new boilers.

DYNAMO ROOM AND ARC SWITCHBOARD.

There are thirty 45-light, three 50-light and seven 125-light arc generators. These are mainly of the T. H. type, but the Brush and the Excelsior types of machines are also employed.

Alternating currents are employed for the distribution of incandescent light and power. For the generation of these currents a T. H. single-phaser and two of the General Electric Company's 150-K. W. triphasers are employed. Separate switchboards are provided for the arc light generators and triphasers.

The main arc light switchboard was furnished by the General Electric Company. It is a five-panel board of Italian marble. It provides for sixty dynamos and sixty circuits. It is 27 feet 6 inches long and 10 feet high, has one voltmeter and five ammeters.

The triphaser switchboard has two panels, and contains all the apparatus for connecting the two machines in parallel.

The triphasers are 12-pole 150 K. W., 600-revolution machines, giving a frequency of alternation of sixty cycles per second. They supply a pressure of from 2080 to 2300 volts, and are over-compounded by an amount which is regulable up to 15 per cent. They are separately excited by small ironclad exciters of the General Electric Company's I. B. types. Their armatures are iron-clad, and have one slot per pole per phase. The machines are regulated from the switchboard. Pressure is delivered to the consumers' premises at 2000 volts to the primaries of step-down transformers, where the pressure is reduced to 110 volts for lighting and power.

DISTRICT SERVED BY THE ENLARGED STATION.

Triphase induction motors and triphase synchronous motors are operated, and give excellent satisfaction.

All the circuits, to the number of about one hundred, enter the building underground, through a cement-lined fireproof vault. About 160,000 feet of underground wire is already operated. All the circuits are passed through T. H. lighting arresters in the vault. From this vault the wires run to the switchboards in specially prepared brackets. All the arc light circuit wires are of No. 6 gauge, insulated with four layers of one thirty-second inch rubber, and coated with fireproof paint. They run through porcelain tube insulators.

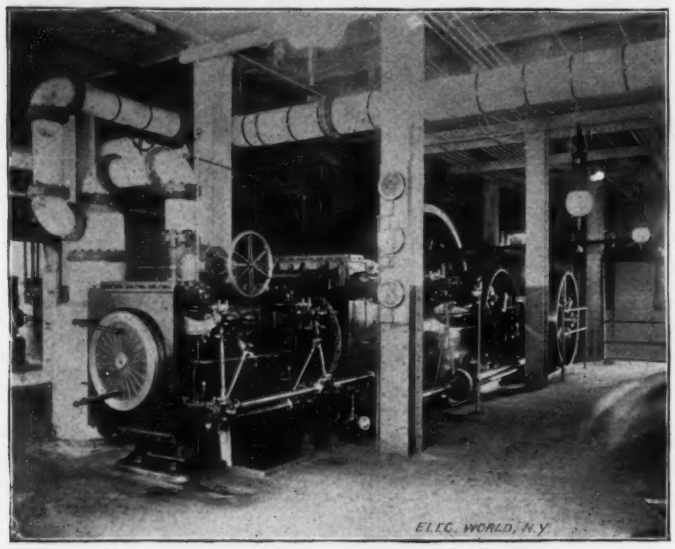
The new engines are of the tandem compound condensing type, made by McIntosh & Seymour, and installed by the Pierce & Miller Engineering Company. The engine cylinders are 24 inches and 46 inches in diameter respectively, and have a 42 inch stroke. They make 105 revolutions per minute. Each engine drives a line of shafting from a 16-foot fly-wheel. The fly-wheel is cast in four sections, has a 74-inch face and weighs 40 tons. The main bearings are automatically oiled by mean of a small pump. The shaft-bearings are 16½ inches by 35 inches. The bearing surface of the crossheads is 540 square inches. All rods are packed with the United States metallic packing. The driving belts are three-ply, five-eighths inch thick and have 72-inch face.

An inspection of the engines shows that they run quietly and regulate well. They are fitted with Goubert separators, and have gridiron valves. They are guaranteed by their makers not to take more than 14 1-3 pounds of dry steam per I. H. P. hour when on economical load.

The new boiler room is provided with four vertical Climax boilers, each of 450 horse-power. Each boiler is 25 feet high, and is furnished with 450 3 inch tubes of three-quarter inch steel, each being 11 feet long. Each boiler has 86 square feet of grate surface, and is fired from four points around it. The boilers before delivery were tested hydrostatically to a pressure of 300 pounds per square inch. They are operated at a pressure of 125 pounds per square inch. They were supplied by the Clonbrock Steam Boiler Company, of Brooklyn, and are guaranteed each to evap-

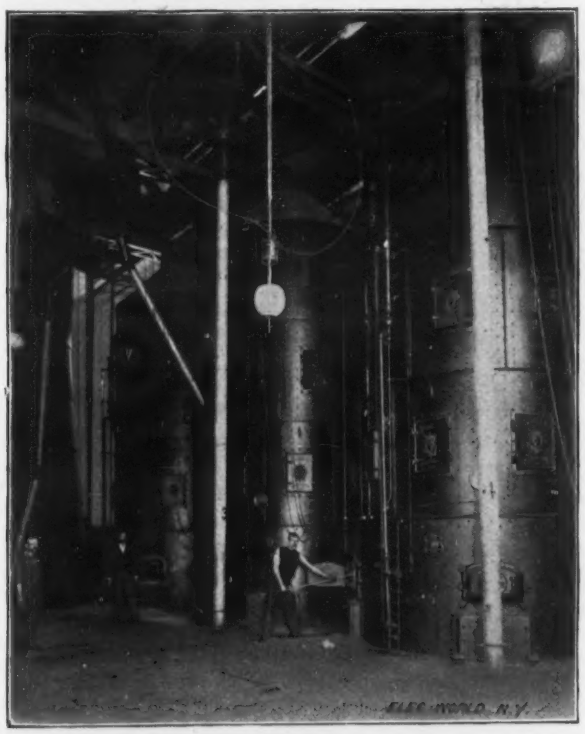
orate 13,500 pounds of water at 100 degrees C. per hour into steam at 70 pounds pressure. The boilers are also guaranteed to not show more than 1½ per cent. of saturation at their rated capacity, and not more than 3 per cent. saturation at 25 per cent. overload. The water columns used are of the "Reliance" type.

The plant is now using buckwheat coal, which is delivered from the street and carried into a storage space above the boiler room by means of a Hunt conveyor. This conveyor has a capacity of 30 tons per hour. The same conveyor is also employed for raising the ashes from the ash pits to the ash storage above the street level. The coal storage space above the boiler room has a capacity



One of the Engines.

of 800 tons without trimming. As the coal is needed it is taken from hoppers and automatically weighed in mid-air. It is then dropped through funnels to the boiler-room floor, being deposited in front of any of the boiler fire doors.



The Boiler Room.

The boilers are supplied with water from the street mains through a 4-inch pipe. The water required for the cooling towers is obtained from two driven wells, capable of delivering 400 gallons per minute.

Two Worthington condensers are connected with the cooling towers on the roof. The water of condensation from the engines is passed to the roof, where it runs through the cooling towers already referred to, and shown in the photograph. A fan, operated by an electric motor, drives air through these cooling towers for the purpose of assisting in the cooling. The condensed steam from the steam pumps is delivered to a Berryman feed-water heater of the vertical type, supplied with by-passes both for water and exhaust steam.

The original brick stack is 10 feet square on the outside and 5 feet square on the inside, and is 125 feet high above grates. The new steel stack is 16 feet in diameter at the base, and tapers to 11 feet in diameter at the height of 35 feet above the base. Above this point its sides are vertical to a total height of 177 feet from the sidewalk. The flues enter this stack from the boilers through two elliptical apertures, one on each side. The stack is lined to a height of 35 feet with 6-inch fire-bricks, the remainder being of ordinary brick. The foundation for this stack comprises 700 tons of masonry. The steel stack was supplied and erected by the Clonbrock Steam Boiler Company.

The officers of the Brooklyn Municipal Electric Light Company have every reason to be satisfied with the success which has attended their efforts. The president, Mr. Mathew Dean, has been connected with the company ever since its inception in 1884. He has served as a director from the starting of the company until 1890, when he was elected president, which office he has since held. The marked success of this company is largely due to his rare business and administrative ability.

Mr. J. N. Bissell has been secretary of the company since 1888. He has ably seconded the president in his effort to place the company on the most economical and best engineering basis.

Mr. B. V. Carver, the chief engineer of the company, has been connected with the enterprise since 1886. Much of the general outlay of the new station was planned by him, and he has superintended its construction on behalf of the company. Its success is an evidence of his ability in this direction.

Mr. James Ferguson has charge of the electrical department and all out-door construction.

The well-known firm of Messrs. Houston & Kennelly were the company's consulting electrical engineers.

The New A. I. E. E. Badge.

At the last meeting of the American Institute of Electrical Engineers a new badge was adopted to replace that worn by the members at present. In direct contrast with the old badge the new one is the height of simplicity, being rather symbolical than illustrative. It is shown full size in the illustration herewith. The gold base has a blue enamel face with gold edges. In the centre of the blue enamel ground are two interlinked circles, representing the relation of magnetism and electricity. The only other decoration are the letters A. I. E. E., which are placed within and above and below the circle. Altogether the badge seems to possess a certain dignity of appearance, and is certainly more in keeping with those of sister engineering societies than its predecessor.

Trolley Cars on the Brooklyn Bridge.

The Brooklyn bridge bill, recently signed by the Governor, authorizes the bridge trustees to suspend the operation of the present railroad on the bridge, and if fully carried out, as is intended, will allow a passenger to ride from any point in Brooklyn to New York City, or vice versa, for the one fare of five cents on any railroad contracting to run its cars over the bridge. The law provides that within sixty days the trustees shall prepare plans and specifications regulating the operation over the bridge of the cars of such corporation or corporations with whom it may contract, as such trustees shall deem best adapted to promote the public comfort and convenience, and to subserve the purposes for which the bridge was constructed; and, except as otherwise provided by the trustees, such plans and specifications shall be in substantial conformity with the plans recommended to the trustees by Virgil G. Bogue, George H. Thompson, and Leffert L. Buck, expert engineers, by their report bearing date February 8, 1897.

The Telephone Repeater.—II.

BY F. JARVIS PATTEN.

An entirely different and interesting class, because it looks so promising, is illustrated by Figs. 7, 8 and 9, though the evident complexity of the machinery in Fig. 7 is discouraging. Here the receiver magnet *E* actuates a movable core, *C*, the movement of which will define that of the diaphragm to which it is attached, and in this feature we see, for the first time, an attempt to retain and amplify a true diaphragm movement in contradistinction to that of a reed or spring which is entirely different. The other novelties introduced in this device, however, more than offset the good before achieved, for on the diaphragm rests a vessel containing mercury,

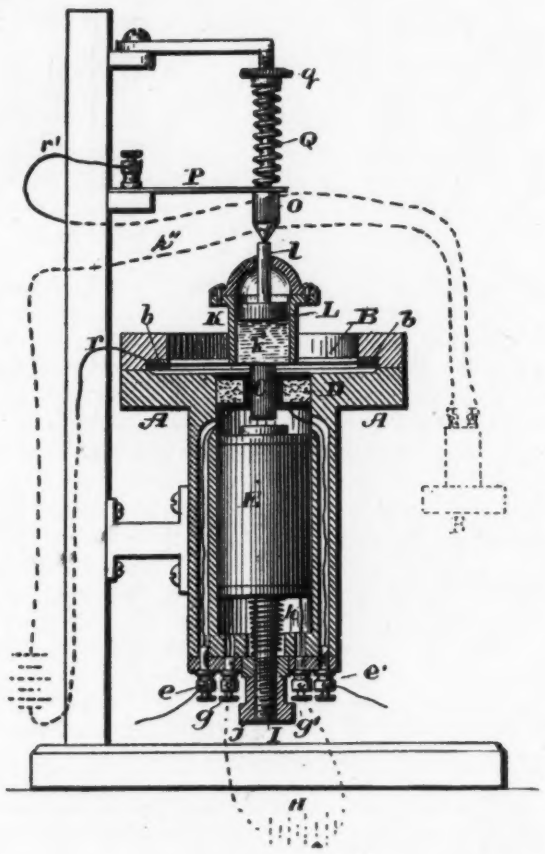


FIG. 7.

and on the mercury floats a piston which is expected to follow the diaphragm movement, and by so doing vary the pressure between the electrodes in contact.

As if fearful this machine might appear a little overloaded, the inventor describes the alternate forms shown in Figs. 8 and 9. In Fig. 8 he disposes of the mercury handicap before placed on the diaphragm, and substitutes for it a piece of elastic rubber tubing, *K*, after describing which he says: "I find the rubber cushion a very sensitive transmitter of the vibrations of the diaphragm to the carbons." The trouble is that in the first form the mercury load on the diaphragm deadens its motion entirely, and in the latter the rubber ring contact, being only a modified form of spring, only transmits vibrations of a certain intensity, all others being absolutely ignored by it.

The last of this order I spent considerable experiment upon, endeavoring to make it delicate enough to give some results. Its elements are shown in Fig. 9. A diaphragm is actuated by a short core drawn into the helix of the receiving coil; the motion actuates an auxiliary diaphragm connected to the ordinary receiving one at its middle point only, the object being to give to the entire surface of the upper one a movement that corresponds to that of the middle point of the receiving diaphragm. On the upper one rested a number of very delicate carbon pencil contacts which I had hoped would follow the diaphragm movement, but they would not do it for me so as to reproduce speech. It seemed from my observations that the very slightest pressure of the carbons was always enough to destroy the accuracy of the movement, and this type after a while followed its predecessors to the scrap pile.

The idea of using a delicately suspended float on mercury without loading the diaphragm with the weight of the mercury itself is a very catchy one. We find this idea best worked out in telephone transmitters, the inventor making no mention whatever of a repeater, but simply having in view the construction of a very sensitive transmitting instrument for the primary line. Two ingenious forms of these are shown in Figs. 10 and 11, and they certainly are exceedingly sensitive transmitters, but the free liquid (mercury) they contain is necessarily a serious objection from a commercial or practical point of view. The one shown in Fig. 11 is the more sensitive of the two, although alike in principle and general construction.

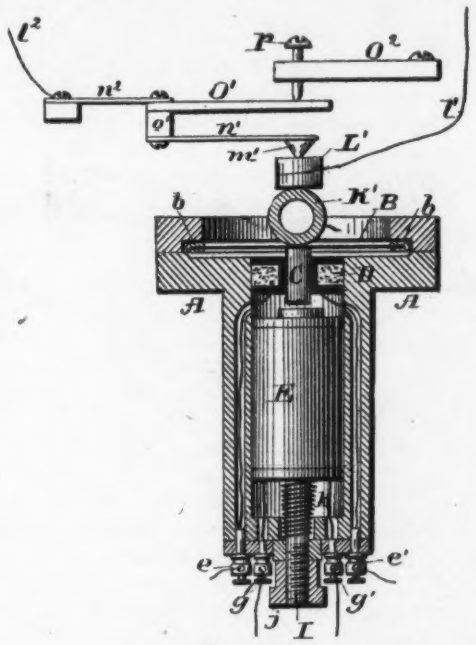


FIG. 8.

A carbon ball, which is at the same time the variable microphone contact, floats lightly upon a surface of mercury contained in a small cup beneath the diaphragm. Nothing but the upper point of the carbon ball touches the diaphragm contact, and this only with the pressure or upward push due to its very slight immersion in the mercury.

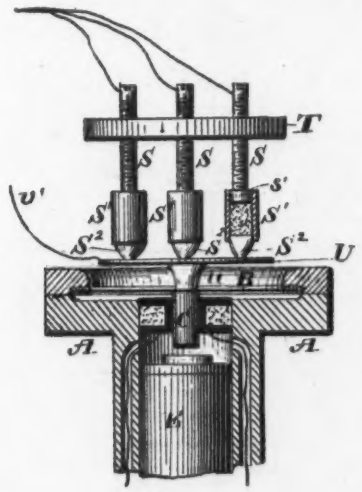


FIG. 9.

The carbon ball is one electrode and the surface of the mercury is the other. As the diaphragm moves up and down under the action of the receiving magnet it should slightly vary the immersed surface of the ball in the mercury, and so change the resistance of a circuit of which they form a part. This is an exceedingly attractive form of repeater on paper. I don't know a better appearing one; but practice introduces difficulties that seem quite impossible to get rid of. We have practically removed the load from the diaphragm, leaving it almost perfectly free to act in a normal manner; there is no lever or spring and the work to be performed

by the device as a machine is reduced apparently to a minimum, all of which is in its favor. In accomplishing so much, however, we have also introduced a slight defect, a new difficulty that has crept in along with and as part of the good conditions. It is this: The mercury surface itself is always free to move, and is almost constantly doing so, whether the diaphragm is moving (in action) or not. The slightest jar—a footfall on the floor—sets this machine roaring, as it were, and when the diaphragm is in action we have about the same extraneous noise as when it is not. The

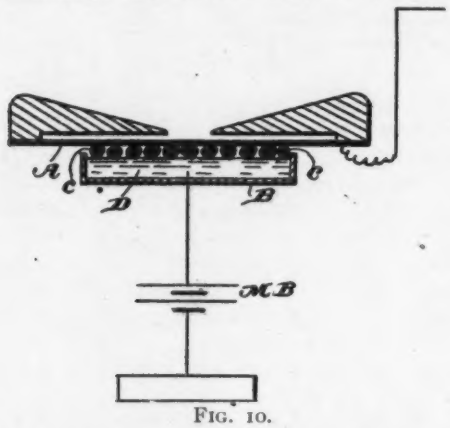


Fig. 10.

modification shown in Fig. 10 explains itself. Of course, in any such form the receiving magnet has to be placed above the diaphragm, which of itself is not a serious objection, but the independent movement of the mercury surface changing the resistance of the microphone circuit at every conceivable shake the thing can get is one that complicates this solution and renders it an extremely difficult one in practice. I have tried this form in a variety of ways, but always found this difficulty pre-eminent, except in original transmitters, a form of which will be referred to later.

Among the various forms of exceedingly delicate transmitters is one patented as late as 1896. It shows a sending or receiving magneto-phone of novel construction, Fig. 12, in which the diaphragm is practically free in space, not being rigidly held, as we are generally accustomed to see it, by a support that is continuous all around its periphery. A strong permanent horseshoe magnet holds the diaphragm between its poles, it being secured at one pole

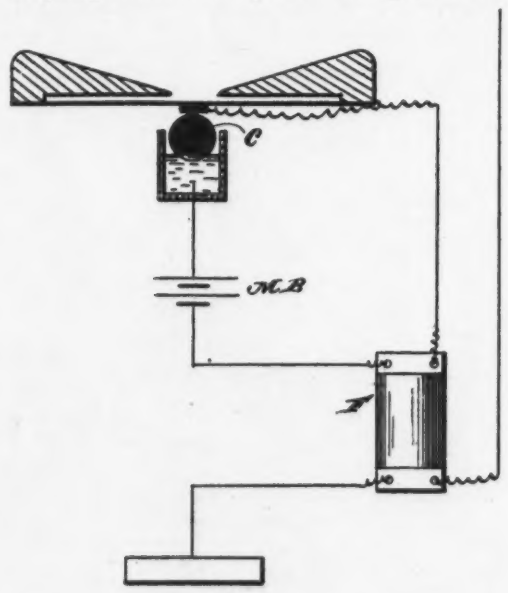


Fig. 11.

and extending nearly across the magnetic field to the other, but not quite, the soft iron of the diaphragm thus forming an incomplete bridge to the magnetic circuit. It is thus suspended in space almost free of mechanical support. The diaphragm, Fig. 12, is, of course, magnetically connected to one pole of the yoke-shaped magnet, but does not reach quite across to the other. The magnetic action thus holds it in position across the field. Such a diaphragm acting as a repeater is provided with the usual microphone contacts for repeating purposes, as shown in the figure which the patent describes as a transmitter only, and one would naturally suppose that its action as a receiver would be very indifferent, inasmuch as the circular diaphragm with rim support is here, to all intents and purposes, changed to a certain form of reed, but I am informed that it makes a sensitive receiver.

An end view of this instrument presents the disc *D*, Fig. 13, suspended between the poles *N* and *S* of the magnet, in contact with the lower pole but not with the upper one. The device is worthy of the attention given it, because it suggests an improvement or alteration by which a telephone diaphragm can be made to retain its position in space without any mechanical attachment or support whatever, a trick that would seem at first sight quite

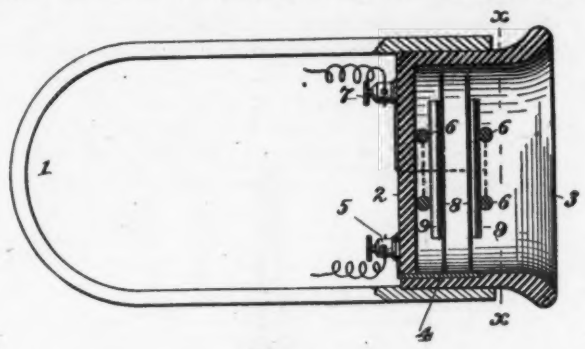


Fig. 12.

impossible; but nothing seems to be absolutely impossible with magnetism and electricity in concert.

The arrangement is shown in Fig. 14, where, instead of using a horse-shoe permanent magnet as before, with the disc attached to one pole, a ring magnet is shown, which is simply given a multiphase current excitation by the biphase leads L_1 L_1 and L_2 L_2 which set up a rotating magnetic field in the gramme ring wind-

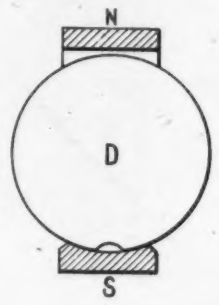


Fig. 13.

ing of the iron ring—the magnetic axis of the field rotating rapidly in the plane of the ring. If now the disc *D* be made of slightly smaller diameter than the inside of the ring, the disc when placed in the plane of the ring will roll around its inside periphery as on a track in its endeavor to bridge the magnetic circuit by keeping the same diameter in line with the revolving field. The disc will stick to the ring at one point, but the point of contact is al-

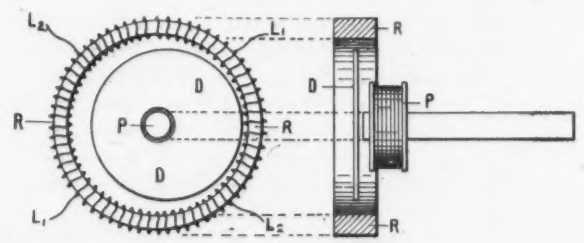


Fig. 14.

ways changing as the disc rolls around, and, as will be seen if the rotating field in the ring turns clockwise, as indicated by the arrow, the disc in rolling will turn contra clockwise about its own axis, but only a small fraction of a revolution in going once around the ring. I have not tried this experiment with a telephone diaphragm, but it should be an extremely interesting one for the following reasons: First, as stated, the diaphragm has absolutely no mechanical support, but has only tangential contact at a single point, which however shifts around the disc so rapidly that it might amount to the same thing as a rim contact all around as far as the diaphragm action is concerned; and, second, and far more

important still, suppose an ordinary telephone bar magnet with coil placed in the usual proximity to the diaphragm at the centre point of the ring (not the disc), then as the disc rolled around the ring, the 'phone magnet would not be acting at the central point of the disc, but at a continuously shifting point of a very small circle around the centre of the disc. This peculiar action would certainly destroy the nodal action, so-called, resulting from having the 'phone magnet at the centre of the disc, and might thus greatly magnify the movement of the receiver diaphragm itself. It is a well-known fact that in phonograph diaphragms in which this nodal action is destroyed, the sound given out, as in the Bettini phonograph, where this is accomplished mechanically, is very much louder and more distinct.

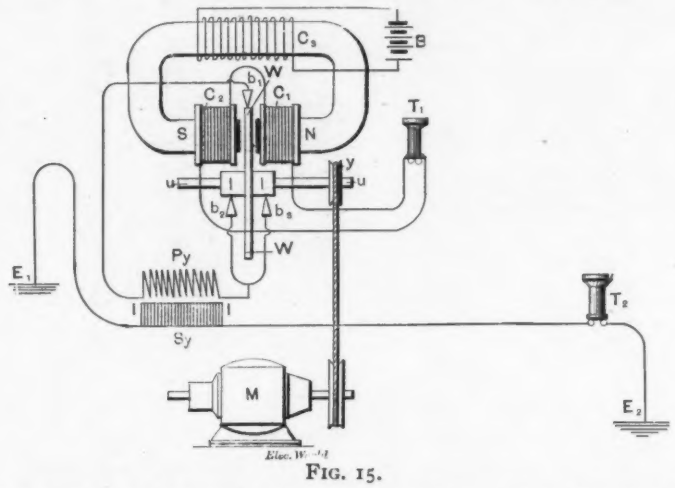


FIG. 15.

A patented specimen, which is *sui generis*, deserves description for the ingenuity of the idea, though the fallacy it contains is almost self-evident. The patented form need not be separately illustrated. The idea is simply the following: Conceive a very minute direct current dynamo, two pole field and gramme armature if you like, with permanent field magnets, its armature being driven by external power which represents the new source or repeating energy of the second line battery.

Let the incoming telephone current from line No. 1 pass through suitable coils on the permanent field magnet. The line current being essentially an alternating current, must vary the excitation of the field of the dynamo, and corresponding but greater fluctuations will appear in the circuit from the brushes, which is then our second line current intensified in proportion as armature current is greater than field excitation. A pretty scheme, but the fallacy is that it is impossible to produce a direct current from a commutator, the fluctuations of which, as the brushes pass from one segment to the next, will not be many times greater than the fluctuations of the armature current produced by the telephonic variations of the field excitation, and the former will entirely obliterate and drown the latter. A modification of this idea, shown in Fig. 15, designed to overcome the aforesaid objection, looked so inviting that I tried it, and it probably was at the same time the smallest and most expensive dynamo per horse-power output ever built. The idea being to avoid the superposed fluctuations of current inseparable from a commutator and brushes, a unipolar dynamo was used, having none, and which would naturally be supposed to give a uniformly smooth direct current. Fig. 15 will be understood without detail description. A small thin disc of silver was rotated at a very high speed in a field, which itself was a mere slit in a very sensitive magnetic circuit separately excited first by a cell of battery, so as to have a field to vary, and second by the telephone receiver coil bringing to the field excitation itself the minutely varying telephone current of the line.

Will some expert please explain why this machine gave no results, and the secondary line is not only silent, but free from the buzzing produced by the commutator system before explained?

Calcium Carbide.

It is announced that large works are to be established near Rheinfelden for the production of this material, the power to be supplied by the large existing hydraulic plant.

Programme of the Niagara Falls Convention.

The official programme of the twentieth convention of the National Electric Light Association, which will be held at Niagara Falls, N. Y., on June 8, 9 and 10, has just been issued.

On Tuesday, after a meeting of the Executive Committee at 9 o'clock, the morning session will be called to order at half past ten, in the convention hall, where after an address by President Frederic Nicholls the Committee on Rules for Safe Wiring will make its report. At the afternoon session the report of the Committee on Finance will be received, after which papers by J. B. Cahoon on "Standardizing Prices for Incandescent Light and Power," and by W. Worth Bean on "Municipal Lighting" will be read. The topic for discussion will be "Theft of Current and How to Deal with It."

On Wednesday the morning session will be devoted to the reading of papers by Messrs. C. L. Edgar on the "Correct Method of Charging for Product;" J. C. White on "Niagara Power Transmission Line;" and Arthur Wright on "Profitable Extensions of Electricity Supply Stations." The topic for discussion during this session will be "Commercial Results with Inclosed Arcs."

At the afternoon session on Wednesday three papers will be read as follows: By Prof. Charles L. Carus-Wilson on "The Induction Factor; a New Basis of Dynamo Calculation and Classification;" Prof. Elihu Thomson, "Recent Progress in Arc Lighting;" and T. C. Martin on "The Daylight Work of Central Stations." The evening session will be given over to the reading of a paper by Mr. L. B. Stillwell, on the subject of "Niagara Power," with illustrations by stereopticon.

On Thursday, during the morning session, papers will be read by Mr. B. F. Lamme on "Polyphase Motors," and Lieut. F. Jarvis Patten on "Frequent Transformation." The topics for discussion will be the "Best Efficiency for Incandescent Lamps" and "Are Large Arc Lighters Commercially Desirable?" At the evening session the topic will be "Lamp Carriers Other Than Ordinary Posts," and a paper will be read by Mr. C. F. Scott on "Rotaries for Transforming Alternating into Direct Current."

At the executive session on Thursday afternoon, reports of the secretary and treasurer and the executive committee will be received and officers for the ensuing year will be elected.

Invitations have been extended to members and their friends to visit the following points of interest: The Niagara Falls Power Company, the Niagara Falls Hydraulic Power & Manufacturing Company, the Buffalo & Niagara Falls Electric Light & Power Company and the Carborundum Company. Arrangements have also been made for excursions to the various points of interest.

The Philadelphia Power House Fire.

Mr. William McDevitt, electrical inspector for the Philadelphia Fire Underwriters' Association, has made his official report on the origin of the fire which destroyed the power house of the Philadelphia Traction Company on the evening of March 3 last.

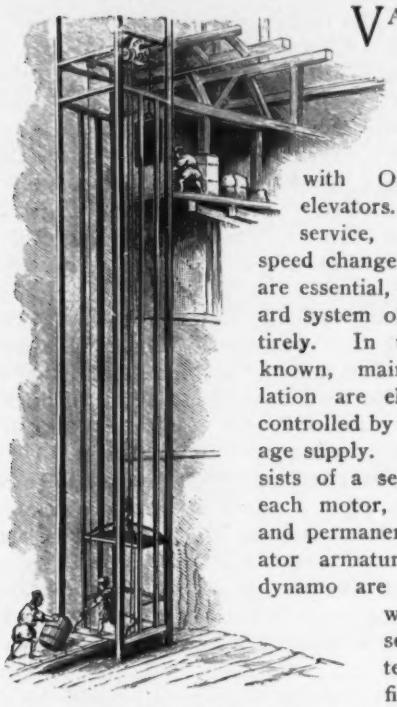
This destructive fire was fully described and its results illustrated in THE ELECTRICAL WORLD of March 13, and the causes as given there are substantiated by Mr. McDevitt's report. The molten metal from the chain which swung against one of the lead heads on one of the generators, and which was the real cause of the fire, spattered down into the fly-wheel pit, setting fire to a board partition at that point, and at the same time igniting the insulation on the conductors. One of the most surprising features observed during the fire was the rapid collapse of the iron roof trusses, which in their descent caused considerable wreckage of pipes and machinery, also letting the burning roof down, thus adding more fire to that partly extinguished at the floor. The origin of this fire is classed by the underwriters as an accident, and Mr. McDevitt states that the occurrence of a similar accident (without causing fire) at another establishment of like character should serve as a lesson to be observed in the future management of all such risks.

Prize Offered for Physical Work.

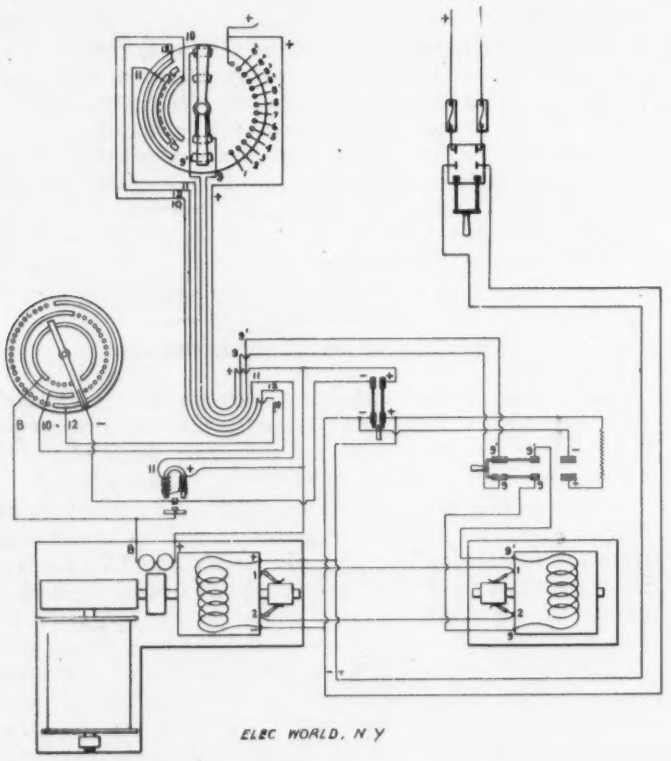
A prize of about $250, the competition for which is open to all nationalities, has been offered by the Reale Instituto Lombardo (Italy) "for experiments elucidating the Maxwell electromagnetic theory." We have as yet no further particulars.

Electric Elevators.—VIII.

OTIS ELECTRICALLY OPERATED ELEVATORS.



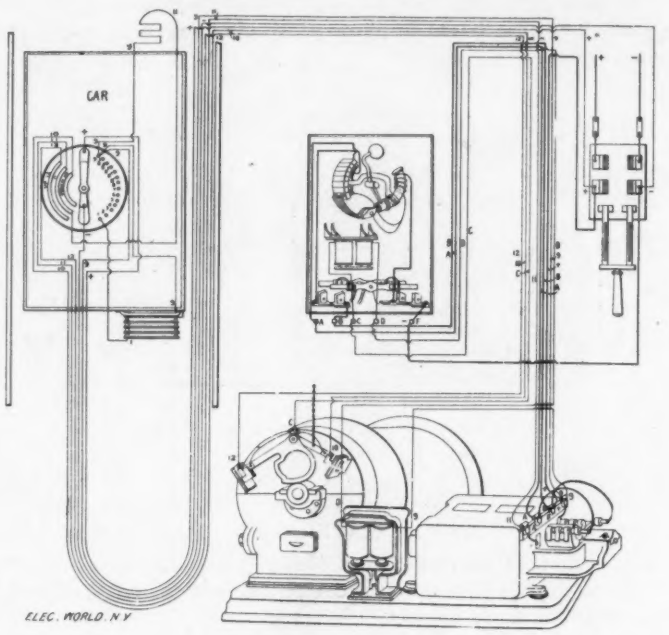
VARIOUS methods of controlling the elevator by means of electrical devices placed in the car have been developed and are quite frequently used in conjunction with Otis drum-winding electric elevators. For high-class passenger service, where rapid acceleration, speed changes, and refinement of control are essential, what is known as the Leonard system of control is used almost entirely. In this system, which is well known, main rheostats for speed regulation are eliminated, the motor being controlled by a direct variation of the voltage supply. In general the method consists of a separate supply generator for each motor, whose armature is directly and permanently connected to the generator armature. Both the motor and dynamo are shunt wound. Both field windings are connected to a separate supply line. The terminals from the generator fields are brought to the elevator car, where they are connected to a field rheostat and reverser arrangement, whereby a variable amount of resistance can be inserted in series with the winding, and its connection to the supply conductors, a tap from which is brought to the car, can be reversed.



VARIABLE VOLTAGE DYNAMO CONTROL.

In starting, the voltage of the generator is reduced to a minimum, but the current supplied to the motor armature is very large, as only the ohmic resistance is to be overcome. The voltage gradually increases in proportion to the speed desired, the consequent increased C. E. M. F. also decreasing the flow of current. No energy is lost in the main starting resistances, although the starting current for equal operation in both cases is far in excess of the normal, yet in the Leonard system the voltage and amperage vary inversely, and the total energy, therefore, to be supplied by the dynamo never exceeds that required for the maximum operating capacity of the motor. It is possible, by the use of this system, when the generator is operated by a motor worked from the common supply mains, to leave out of consideration the amount of current necessary to start the elevator machine, as this has but very little serious effect upon the supply main to which the generator driving motor is connected.

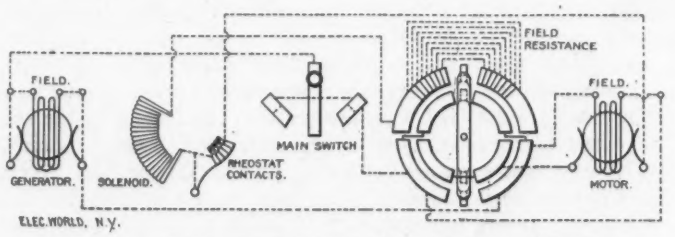
Where the system is used, the elevator machine is practically similar to any of the previously described Otis drum-winding electric



MOTOR FIELD CONTROL.

elevators, and may be either of the single or double gear type. Instead, however, of employing a mechanically operated brake, electromagnetically operated braking mechanism is used, the magnet being energized, lifting the brake when the dynamo first starts to generate. This brake is only used to hold the elevator machine, not for stopping ordinarily.

The method of current supply of the motor may consist of various combinations of engines and dynamos or motor generators. Where, for instance, current is taken from the street service supply a motor generator would be installed, the motor being operated from the street service, while the dynamo is connected to the elevator machine and controlled as above described. In a recent installation of this type a very ingenious arrangement consists of a single motor centrally placed between two generators, each of which supplies its own respective elevator machine. The motor



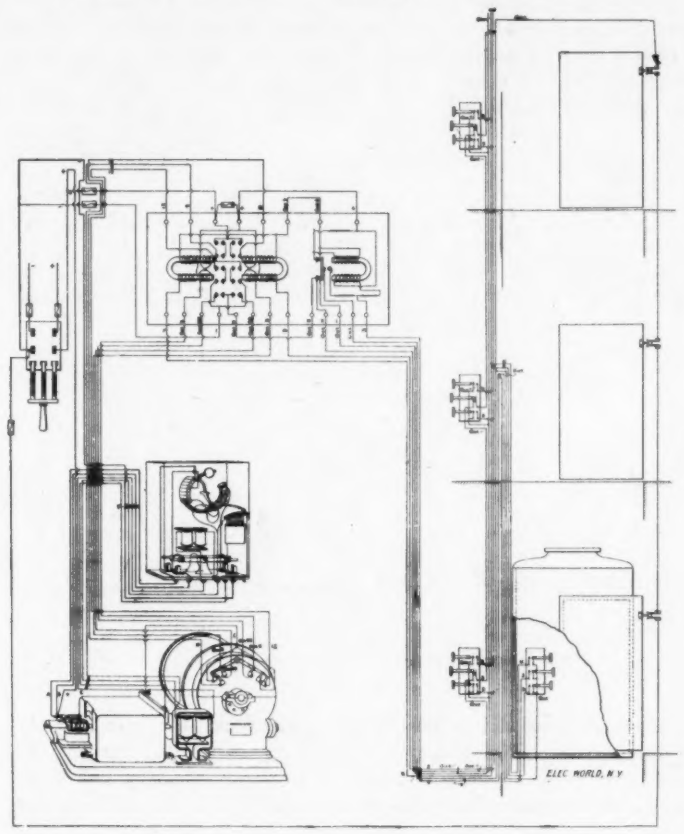
SCHEMATIC DIAGRAM OF SHUNT MOTOR FIELD CONTROL.

generator apparatus is so arranged by means of suitable switches that should the driving motor be disabled either of the dynamos could be used as a motor to operate the other, thereby still permitting the use of one-half of the plant.

In some cases, where isolated current supply plants are possible and advisable, each supply generator may be separately connected to a single separate engine, but in the latest and most approved installation a number of dynamos are arranged to be operated by one or more engines. This arrangement is shown in the diagram. A long shaft is fitted with four dynamos, the armatures of which are directly mounted thereon. Each end of the shaft is clutch connected to an engine, and another clutch is placed centrally between each pair of dynamos. By means of this arrangement the combination may work complete when all four elevator machines are in operation, one engine may work all or half of the

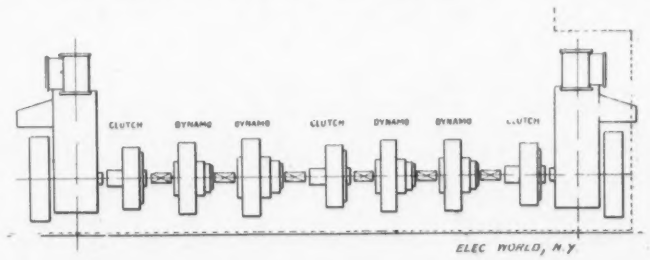
machines, or either engine may easily be disconnected. The peculiar advantages of this arrangement of generating apparatus, particularly in connection with this system, are obvious.

The diagram herewith shows the general arrangement of apparatus and connections as used in the working arrangements of this system. The car switch and rheostat are operated from a central open position suitably connecting the generator fields, and



AUTOMATIC PUSH-BUTTON CONTROL.

increasing or decreasing the current in them. Usually this controlling resistance and switch are attached beneath the car floor and operated by a chain-connected hand wheel. In conjunction with the first movement of this switch a small magnet is energized, which, pulling up its armature, throws into connection the brake magnet coils and releases the brake band on the elevator motor shaft. At the elevator machine a switch and rheostat similar to the car device are provided and connected with the automatic safety stop mechanism which has been described, so that when any of the safeties are operated this switch and rheostat are moved sim-



ARRANGEMENT OF DYNAMOS FOR VARIABLE VOLTAGE CONTROL.

ilarly to the car device and automatically stop the elevator motor. The generator fields are connected to a double-throw switch, which when thrown over from its shown position disconnects the car-controlling device and connects the generator fields to the line through a resistance. This arrangement is essential in order to operate the elevator motor, when it is desired to control the car otherwise than through the operation of the car device. In connecting the generator fields by throwing over the switch, however, the resistance which is thrown in series with them permits only a small percentage of the maximum voltage to be generated, resulting in a correspondingly slow car movement. The action and operation of the system may be readily seen from the diagram.

A peculiar means of holding the car is used in this method of operation. Instead of opening the field circuit of the dynamo and thereby stopping its generation, the rheostat in the car is handled so as to maintain a current in the generator and motor armatures, which produces just sufficient pull to balance the weight on the car. Therefore, by properly manipulating the car rheostat it is possible to cause a very gradual and even stopping action and entirely stop the car without the application of the brake shoes.

Another method of electrical motor regulation from the car, which is sometimes installed by the Otis Company, is shown diagrammatically. Starting, stopping and speed regulation is obtained by controlling the shunt motor field by a variable resistance and reverser located in the car. The connection of the shunt field also energizes a magnet which is in circuit therewith and which operates a main switch lever arranged to connect the motor terminals to the line. The operation of this switch sets into action a series solenoid, which by an action similar to that used in the standard controller previously described, gradually cuts out a series starting resistance and the series starting coils of the motor. When the resistance is all out the motor operates as a shunt motor, whose fields can be variably controlled by the resistance in the car to produce different speeds. The safety devices shown on the machine directly operate switches which control the switch-operating and brake magnets.

For residence service an automatic motor control has also been devised. Two general methods are used, one in which the operating devices at the various floors consist of a three-contact arrangement, for stop, upward and downward operation of the car. Similar contacts on the different floors are connected together, and each set of operating contacts are connected to a relay magnet which operates suitable switch devices controlling the circuit of a magnetic main switch, which in turn operates similarly to that used with the shunt motor field control method. This method of control and arrangement is also shown diagrammatically, and will probably need no further description, as its operation can readily be seen from the arrangement of conductors. In another system of automatic control a single button is used and automatic floor limit switches are provided at the car, so that by the operation of the button at any floor the car is brought to that particular floor and automatically stopped, whether it be above or below the point to which it is to be brought. In conjunction with both of these systems automatic safety devices and switches are provided, arranged to prevent the elevator operating if any of the shaft doors should be open, or the car in motion in response to a previously operated device.

Exhibition of Vacuum Tube Lighting.

On Thursday evening, May 27, the Moore Electrical Company gave an exhibition at its laboratory in Newark, N. J., of the results obtained by Mr. D. McFarlan Moore in vacuum tube lighting. It will be remembered that about a year ago Mr. Moore gave an exhibition of lighting by these tubes before the American Institute of Electrical Engineers, and also that he showed his system at the Electrical Exposition held in this city in May, 1896. At the demonstration in Newark the light was steadier and more intense than at the former demonstration. A booth of white fabric had been erected inside the building, and this was illuminated by fourteen large tubes suspended about the edges of the ceiling and down the centre. In addition to these were several advertising signs constructed of vacuum tubes, which were exhibited as the first commercial utilization of this new illuminant. Mr. Edward J. Wessels, the president of the company, in opening the demonstration, made a very flattering address concerning the work done by Mr. Moore in tube lighting. He then introduced the inventor to the audience of about fifty who were present. Mr. Moore stated that the demonstration was not intended to be scientific in its nature, but only popular, and performed a number of well-known Geissler tube experiments for the entertainment of his audience. No facts or figures were given out as to the operative efficiency of the system and its consumption of power. The light in the room was sufficient to read by, though by no means strong. The vacuum interrupter, which has been a feature of Mr. Moore's apparatus, has been discarded for an instrument he calls a "rotator," which he claims is capable of giving a greater frequency of interruption.

Alternating-Current Machinery.—X.

BY EDWIN J. HOUSTON AND A. E. KENNELLY.

REACTANCE.

92. We have seen that the current in a simple alternating-current circuit, containing both resistance and inductance, is determined by Ohm's law from the resultant E. M. F., which is the sum of the impressed E. M. F. and the E. M. F. of self-induction. The latter, however, is not a fixed quantity, but depends for its magnitude upon the strength of the current. The simplest practical method of procedure is to ignore the E. M. F. of self-induction and to determine the impedance of the circuit, since this is a constant quantity so long as the frequency and type of E. M. F. do not change.

93. If we multiply the inductance, l, of a coil or circuit, by the angular velocity ω of the sinusoidal current passing through it, the product, $l\,\omega$, is called the *inductive reactance* or simply the *reactance* of the coil. Thus, if a coil of wire, in an alternating-current circuit, has an inductance of $l = 5$ millihenrys $= 0.005$ henry, then, to a sinusoidal alternating-current of 140 cycles per second (16,800 alternations per minute), the angular velocity of which is $140 \times 2\,\pi = 879.65$ the reactance, $l\,\omega$, of this coil will be $0.005 \times 879.65 = 4.398$ ohms. With a frequency of 60 cycles per second. the angular velocity $\omega = 60 \times 2\,\pi = 377$, and the reactance $l\,\omega = 377 \times 0.005 = 1.885$ ohms. With a frequency of 25 cycles per second the angular velocity $\omega = 25 \times 2\,\pi = 157.1$ and the reactance $X = l\,\omega = 157.1 \times 0.005 = 0.7855$ ohm. The reactance evidently increases directly in proportion to the frequency of the current, provided the current is simply sinusoidal. At a very high frequency the reactance would be very great. At an indefinitely low frequency, *i. e.*, with a continuous current, the reactance disappears altogether; in other words, there is no inductive reactance to a steady continuous current.

94. The impedance of a coil or circuit is the vector, or geometrical, sum of its resistance and its reactance; but the reactance is always to be considered as at right angles to the resistance with which it is associated. Thus, if a coil of resistance, R, has a reactance, X, the prefix j has to be applied to the reactance, so that it becomes jX and the impedance of the coil is $Z = R + jX$, or $R + j\,l\,\omega$ ohms.

Thus, taking the above assumed coil, if this had a resistance of 2 ohms, its impedance, Z, to a sinusoidal current of 140 cycles per second, would be $R + jX = 2 + j\,4.398$ ohms. This vector sum is shown in Fig. 57 to be the vector (§ 68) of length $\sqrt{2^2 + 4.398^2} = 4.832$ ohms, having an angle whose tangent is $\frac{X}{R} = \frac{4.832}{2} = 2.416$, corresponding to 65° 33′. Consequently, the impedance $= 4.832\ /65°\ 33'$ ohms.

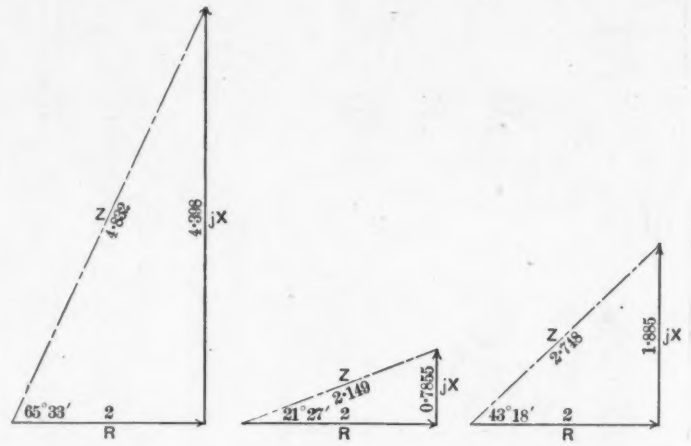
If the same coil were connected on a 60-cycle circuit, its reactance, as already pointed out, would be $j1.885$ ohms; and the impedance $Z = R + jX = 2 + j\,1.885 = \sqrt{2^2 + 1.885^2} = 2.748$ ohms, making an angle whose tangent is $\frac{X}{R} = \frac{1.885}{2} = 0.9425$, or corresponding to 43° 18′, so that the impedance $Z = 2.748\ /43°\ 18'$ ohms, as shown in Fig. 58. The ratio $\frac{X}{R}$ is sometimes called the *reactance factor* of the coil.

If the same coil were connected on a 25-cycle circuit, its reactance, $jX = j\,0.7855$ ohm, and its impedance, $Z = R + jX = 2 + j\,0.7855 = \sqrt{2^2 + 0.7855^2} = 2.149$ ohms at an angle whose tangent is $\frac{0.7855}{2} = 0.3928$, corresponding to 21° 27′, so that $Z = 0.3928\ /21°\ 27'$ as shown in Fig. 59.

The impedance of a coil or circuit, to a sinusoidal current may, therefore, be represented geometrically as a plane vector whose magnitude and angle both depend upon the frequency, as well as upon the inductance and resistance of the coil. In other words, the inductance and resistance may be regarded as the fundamental constants of the coil, which do not vary with the frequency, at least within the limits of commercial frequencies, while the reactance jX and the impedance $R + jX$, involve the frequency, and become secondary constants when the frequency is constant,

95. Having obtained the impedance of a coil or circuit, the current strength in the circuit falls immediately under Ohm's law. Thus, in the continuous-current circuit, we know that the current is $I = E/R$ amperes, where E is the E. M. F. in volts, and R the resistance in ohms. Similarly, in the simple (sinusoidal) alternating-current circuit $I = E/Z$ amperes, where E, is the impressed E. M. F. in volts, and Z is the impedance in ohms. If E be expressed as an amplitude (§ 11) the quotient, I, will be similarly expressed as an amplitude or maximum cyclic value. Usually, however, E is expressed as an effective value (§ 49), such as would be shown by a properly calibrated voltmeter; and I is then a similar effective value, such as would be shown by an ammeter.

96. Whereas the formula for Ohm's law pertaining to continuous-current circuits is a simple arithmetical or algebraic formula, the formula for Ohm's law pertaining to alternating-current circuits, is a vector formula, since Z is a vector quantity. We are thus led to examine the rules for the multiplication and division of vectors.



Figs. 57, 58 and 59.—Impedance of Coil at 140 ∼, 25 ∼ and 60 ∼.

97. If $A\ /\alpha$ and B/β are two plane vectors, their product is $AB/\alpha + \beta$, and the quotient of the former divided by the latter is $A/B/\alpha - \beta$.

Thus, Fig. 60 shows two plane vectors, A and B. $A = 3/60°$;

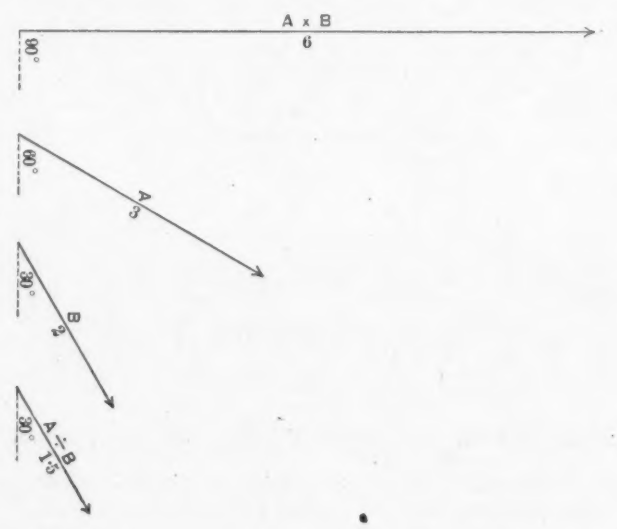


Fig. 60.—Multiplication and Division of Vector Quantities.

$B = 2/30°$. The product of these two vectors is $AB = 6/90°$, and the quotient $A/B = 1.5/30°$.

Again, Fig. 61 shows two plane vectors, C and D. $C = 4/30°$; $D = 1.5/45°$. The product CD, is $4 \times 1.5 = 6/45 - 30 = 6/75°$, and the quotient $C/D = 4/1.5/30 - 45 = 2.667/-15° = 2.667/15°$.

98. If, therefore, we connect the above considered coil to the secondary terminals of a transformer assumed to deliver 50 volts effective

under all conditions of load, the effective current strength, if the frequency be 1 :o cycles, will be $I = \frac{50\ /0^\circ}{4.832\ /65^\circ\ 33'} = 10.35\ /-65^\circ\ 33'$ $= 10.35\ /65^\circ\ 33'$ amperes. If the frequency of the current supplied by the transformer be 60 cycles per second, the impedance of the

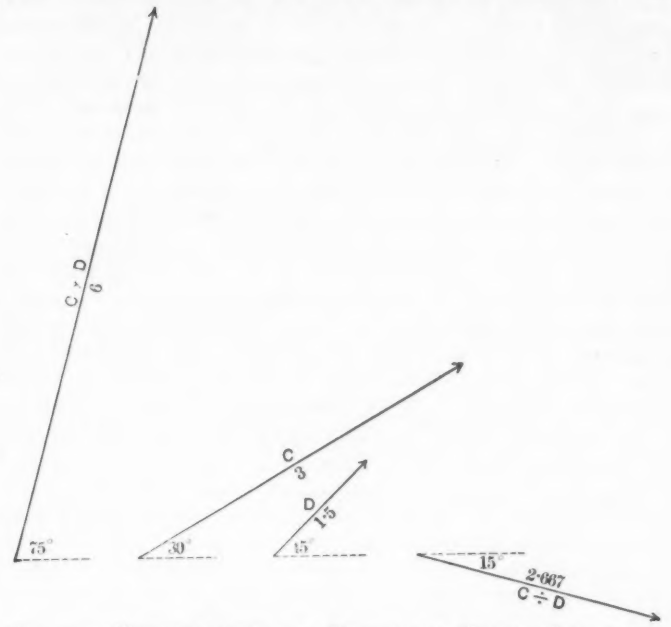


FIG. 61.—MULTIPLICATION AND DIVISION OF VECTOR QUANTITIES.

coil will be, as already pointed out, $2.748\ /43^\circ\ 18'$ ohms, and the current strength through the coil will be $\frac{50\ /0^\circ}{.2748\ /43^\circ\ 18'} = 18.2\ /43^\circ\ 18'$ amperes, while if the frequency were 25 ~ the impedance of the coil would be $2.149\ /21^\circ\ 27'$ and the current strength through the coil would be $\frac{50}{2.149\ /21^\circ\ 27'} = 23.26\ /21^\circ\ 27'$. These currents are represented to a suitable scale in Fig. 62, in relation to the impressed E. M. F.. The currents lag behind the E. M. F. by the angles of 65° 33', 43° 18' and 21° 27' respectively.

99. Referring to paragraph 89, the coil of 5 ohms resistance having an inductance of 0.010 henry, and receiving a current of

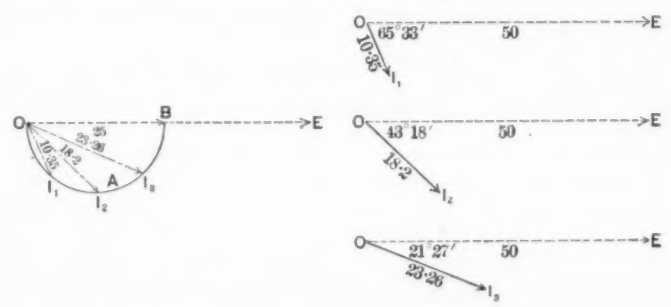


FIG. 62.—APPLICATION OF OHM'S LAW IN SIMPLE ALTERNATING-CURRENT CIRCUIT OF 140 ~, 60~, OR 25 ~, AT CONSTANT PRESSURE.

60 ~ frequency has a reactance of $j\ 60 \times 2\pi \times 0.01 = j\ 3.77$ ohms; or, an impedance of $5 + j\ 3.77 = \sqrt{25 + 14.22} = \sqrt{39.22} = 6.263\ /37^\circ\ 1'$. Consequently, the current strength passing through the coil is, in the case there considered, $\frac{50}{6.263\ /37^\circ\ 1'} = 8\ /37^\circ\ 1'$; or a current of 8 amperes, lagging 37° 1' behind the impressed E. M. F. in phase, and this is the current shown in Figs. 54 and 55.

100. An examination of the cases represented in Fig. 62 will show that the vector current strength in the circuit always falls upon the circumference of a semi-circle, $O\ A\ B$. $O\ B$ is the current strength (25 amperes), which would flow if there were no reactance, and OI_3, OI_2, OI_1 are the successive currents for the cases of increasing reactance already considered. Consequently, as we introduce reactance into a simple alternating-current circuit, keeping the resistance constant, the vector current retreats along a semi-circle. The reactance may be increased either by increasing the frequency with the inductance unchanged, or by increasing the inductance of the circuit, leaving the frequency unchanged. At an indefinitely great reactance the current strength is indefinitely small, and is at right angles to the impressed E. M. F. Although, as we shall see later, the secondary effects of introducing iron into a circuit slightly modify the results, yet for many practical purposes we may consider that if a coil of appreciable resistance, with comparatively few turns, and, therefore, small inductance and reactance, is connected across the mains of a simple alternating-current circuit of a constant pressure and frequency, say 50 volts and 125 lb, the resulting current will be nearly in phase with the impressed E. M. F., and its magnitude will be nearly E/R amperes. As we introduce an iron core into the coil, the inductance and reactance increase, and the vector current lags behind the impressed E. M. F. along the semi-circle, having the current of no reactance for diameter; until, when the iron core is large and is completely closed, as in a ring or transformer, the vector current is very small and nearly at right angles to the impressed E. M. F.

In reality, it is the resultant E. M. F., considered as the vector sum of the impressed and reactive E. M. Fs., which retreats along the semi-circle and which, therefore, carries its resulting current with it (§ 89), but for all practical purposes it is simpler to consider that there is no reactive E. M. F. of self-induction, but a reactive resistance or reactance in the coil, and that the impressed E. M. F. produces through the vector impedance the vector current by the application of Ohm's law.

Duties on Carbons and Electrodes.

The Board of General Appraisers of the Treasury Department, Washington, D. C., has rendered decisions in two cases of special concern to electric light interests. The first was a protest against the decision of the collector of customs at New York as to the rate and amount of duties chargeable on imported electric light carbons. The General Appraiser holds that the carbons are dutiable at the rate provided in paragraph 86 of the tariff act of 1894, for articles composed of earthen or mineral substances not specially provided for by the act. This rate is 30 per cent. ad valorem. The importers made various claims in different protests, the principal ones being that the carbons were entitled to free entry under paragraph 443, as products or preparations of coal tar. The appraiser overruled the protest and affirmed the decision of the collector.

The other case was that of a protest against the decision of the collector of customs at Newport News, Va., as to the rate and amount of duties chargeable on carbon electrodes to be used in the reduction of mineral substances.

The duty assessed upon these electrodes was 30 per cent. ad valorem. The importers claimed that the duty should have been 20 per cent., under section 3 of the act of August 28, 1894. The General Appraiser holds that the electrodes should be classified as articles composed of earthen or mineral substances, as provided under paragraph 86. The protest in this case was also overruled, and the collector's decision upheld.

Registering Fares on Street Railways.

A curious measure was enacted by the Connecticut Senate at Hartford, on April 29, when a bill was passed providing that "every person whose duty it shall be to collect fares or tickets on any street railroad car who shall intentionally neglect to register as soon as received by him any fare or tickets so received on the register provided for that purpose, shall be fined not more than $50 or be imprisoned not more than three months, or both." Senator Kendall, who introduced the bill, explained that such a law appeared to be necessary.

Electric Railway in Monterey, Mexico.

A dispatch from Monterey, Mexico, states that negotiations have been completed there for the purchase and consolidation of the street railways in that city and their equipment with electric motive power by an American company. It is stated that the amount involved in the transaction is about $6,000,000.

An Action of Fluorescent Substance on the Cathode and X-Rays.

BY W. R. TURNBULL.

In this note I wish to call attention to a phenomenon which is of theoretical interest rather than of practical importance.

While watching the exhaustion of an X-ray tube, I noted that, under certain conditions, the approach of a fluorescent screen close to the tube produces a stoppage of the discharge within the tube, the conditions being that the vacuum be "high," and that there be a multiple circuit of slightly higher resistance than the resistance of the tube, through which the discharge may pass when it ceases to pass in the tube.

In the first instance in which I observed this action one of the wires leading from the inductorium was in contact with a system of iron pipes, while the other wire passed by another pipe of the system having a short air-space between it and the pipe. Under these conditions, the vacuum being "high," the approach of the fluorescent screens (calcium tungstate), close to the bulb, caused the discharge in the tube to cease, sparks passing from the wire through the air space to the pipe. Upon withdrawing the screen the discharge in the tube was re-established. This could be repeated as long as the conditions remained right, but the conditions have to be adjusted with considerable nicety, thus showing the action to be rather feeble, but nevertheless plainly existent.

The approach of substances other than the fluorescent screen caused no noticeable effect upon the discharge.

This action was noted with two different tubes, and it could easily be studied with apparatus having the proper adjustments for vacuum and multiple circuit.

The effect of this action is apparently to increase the internal resistance of the tube to the passage of the discharge, and the cause would seem to lie in the emission from the fluorescent screen (when it is not fluorescent) of certain rays, which either increase the resistance of the vacuous space or interfere with and oppose the rays from the cathode.

To give intelligent opinions regarding the cause and real effect of this action would necessitate further experiments, and I trust that the matter may be taken up by one having more leisure to experiment than myself.

In this connection it might be well to mention a phenomenon which has probably been noted by others, but which has not, I think, been described in any of the magazines. My attention was called to it by Mr. J. W. Heller, and he has noted the recurrence of it a great many times while exhausting X-ray tubes. If the vacuum of the tube has become just so "high" that the discharge ceases to pass in the tube, the discharge in the tube will be re-established by bringing the hand very close to, or in contact with, the tube. It seems to me that this can be explained when we consider that the discharge passes from anode to cathode, both inside and outside the tube, and when anything, such as the hand, is brought to the outside of the tube and decreases the resistance of that part of the circuit, the discharge is re-established on account of the decrease in total resistance.

That the discharge passes outside as well as inside the tube is well demonstrated by the fact that when one places the fingers close to the tube (when the discharge is passing) one feels a sensation as of little puffs of air blown against the fingers. This sensation, I take it, is caused by the passage of the discharge on the outside of the tube through the finger tips, as the "puffs" are synchronous with the vibrations of the inductorium contact breaker.

The Inventor and the Technical Journal.

To the Editor of The Electrical World:

Sir—I notice in your issue of May 22 an interesting article by Mr. Albert Scheible, on the relations existing between inventors and technical journals. While I think that all must agree with his conclusions in regard to the small value of the average "inventor's journal" and the high value of the high-class technical papers, yet I am unable to agree with some of his statements, and think that one of them should not pass uncontradicted. He states, in effect, that any patent on a device which is controlled by a fundamental patent, that is to say, any specific patent, is worthless, and that money spent upon it "has simply been thrown away."

It is a fact that almost all patents are specific, in this sense. It is particularly true in the electrical art. For example, consider the large and important classes which relate to alternating motors and the transmission of power. Nearly all of these patents are controlled by the broad Tesla patents of May 1, 1888. And yet the two great companies, and numbers of smaller companies, as well as unattached inventors, are taking out such patents in great numbers, and spending, in some cases, many thousands of dollars in fighting interferences concerning them. Many of these specific patents are extremely valuable. Suppose that an inventor devises a new multiphase motor, which can be built cheaply, or which will regulate well, or which is in any way preferable to the commercial types. He obtains his patent, and finds that he cannot use his own motor on account of the Tesla patents. But the Tesla patents do not run forever, and after they expire, he can make and sell his motors freely. In the meantime, he can keep others from selling them. And if the motor is really better than anything else on the market, for any particular use, the owners of the broad patent will find themselves obliged to buy the specific patent, and to pay for it a compensation which will well repay the money and time spent upon it.

The writer does not seem to realize what a serious undertaking an "infringement search" is. The search itself may cost $50, and may cost many times that. Suppose that such a search reveals that five claims of prior patents appear to cover the device. It is then necessary to make validity searches on all five of these claims, to find out whether they are valid, and whether they can be construed broadly enough to cover the specific case. Such an investigation might easily cost $500 or $1000, if made by a competent attorney, skilled in the art. If made by any one else it would be worthless. In practice, the question of infringement is seldom raised in this work. If a device is new, useful, and patentable, and if it will have a commercial value at any time within the seventeen years of its life, it is worth patenting. When the patent is obtained, the inventor has his choice of making and selling the article himself, or of selling it to one of the large companies. If he elects to sell it, it makes little difference whether or not it is subordinated by some prior patent, as the companies to which he sells it will probably own the prior patent, or at least a license under it. If he elects to make it himself, he should have an infringement search made. But not one inventor in a hundred cares to make and sell his invention, or has at his command the necessary shops and tools. Whether his patent was subordinated or not he would prefer to sell it, and it is therefore immaterial to him whether or not the two or three companies which are in a position to use it have or have not broader patents covering his invention.

Of course, it is true that the specific patent would be more valuable in the absence of the broad one. But it is not true that the presence of the broad one makes it "worthless," if the invention covered by the specific patent is one of real commercial value.

It should also be remembered that the specific patent of to-day is the broad patent of to-morrow. The Berliner application was filed as a specific improvement in the art of telephony. It is, to-day the fundamental patent in that art, and, if valid, is of the highest value. This is, perhaps, an exceptional case, but many other cases arise every year in which the same principles are involved.

ALBERT GOULD DAVIS.

Rapid Transit in New York.

The Rapid Transit Commissioners, the New York *Herald* says, will apply to the Supreme Court early next week for the appointment of a commission to approve the plans adopted to provide rapid transit for New York City. The commissioners, it is stated, came to the conclusion that unless the work of the commission could be finished and the contracts let within the present year there would be no probability for many years to come that Manhattan Island would be given an adequate system of rapid transit, on account of the new order of things which will take effect on January 1 next, when Greater New York becomes a fact. The consents of property owners have not been obtained as rapidly as the circumstances call for, and the aim of the commissioners now is to report their plans to the Supreme Court, and after the judges have confirmed the feasibility of the present plans, the commissioners may proceed without the consent of the property holders entirely.

DIGEST OF CURRENT TECHNICAL ELECTRICAL ARTICLES FOREIGN AND AMERICAN JOURNALS

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DYNAMOS, MOTORS AND TRANSFORMERS.

Three Phase Motors with a Variable Number of Poles. DAHLANDER. *Elek. Zeit.*, May 6.—It is well known that the speed of such a motor may be changed by changing the connections so as to alter the number of poles, and the use of this method has been suggested for traction; it has however usually been used only with ring windings. In the present article he describes the application to drum windings, as he considers that of greater importance; he describes a winding which he devised in conjunction with Lindstroem and which has been tested by a Swedish company; diagrams are given for a motor of 12 coils, the ends of each coil being provided with terminals which can be variously combined to produce 8, 4 and 2 poles; the large number of connections however involves complication and a certain amount of differential action owing to opposing currents in the wires in the same hole. The case is greatly simplified if the number of poles is merely to be doubled; two coils belonging to the same phase can then be connected in series so that each phase is divided into two halves, involving 12 branch wires; a diagram of this is shown; such a motor for 8 and 4 poles was tested and it was found that the no load current was the same in both, showing an appreciable differential action. It is not necessary, however, that the coils are wound in two neighboring holes but may cross each other as usual, and this gives much better results, the differential action being much smaller, the no load current for 8 poles being only one-third that for 16 poles; with a smaller number of poles the two halves of each phase should then be connected in parallel, whereby the no load current as well as the output, was increased; this necessitates three branch wires for each phase but the three short-circuited ends can always be connected together and with a common branch, reducing the number of branch wires to seven; a diagram is given; tests gave very satisfactory results; the starting torque was considerably greater than the normal; an important advantage of this method is simplicity.

Theory of Double-Field Machines for Three-Wire Systems. ROTHERT. *Elek. Zeit.*, April 29.—The conclusion of his article (see *Digest*, May 15). He discusses the properties of the double-field machine, giving the results of experimental tests; the same principle can be applied to the five-wire system, which however is now seldom used. He describes the practical experience with three-wire machines; the principal fault was that by short circuits or when the machine was started, or when the exciting circuit was opened suddenly, the poles of one branch are liable to be reversed in polarity; this was completely overcome by making each branch of the two exciting currents circulate around diametrically opposite poles; thus each exciting circuit excites one of the poles of the other circuit, and it is therefore impossible to excite one branch without at the same time exciting the other, the poles can therefore not reverse; a further advantage of this device is that it tends in a measure to equalize the two different voltages in the two branches due to changes in the load; this reciprocal excitation can also be applied to the compound winding. In most cases the use of such a single machine will result in an economy of first cost and often also in a simplification of the operation of such an installation; the efficiency of such a machine is not below that of the usual forms and is more likely to be better; such machines have been in very satisfactory use in many installations and in some of them for two years.

Armature Reaction and the Theory of Commutation. HAWKINS. Lond. *Elec.*, May 14.—A continuation of his serial. He discusses the Sayers armature by means of the same method and shows that the forward magnetizing loops of this armature are on exactly the same level as the stationary windings on the field magnet; the self-excitation feature of this armature is therefore nothing more wonderful than the ordinary self-excited dynamo. He explains the same on the assumption of line leakage instead of line cutting, stating that both methods are equally correct; the discussion of the question of sparking is then begun on the assumption that sparking is caused by the stored-up energy and the distortion of the field.

Non-Synchronous Motors. KUEBLER. *Elek. Zeit.*, April 29.—A brief criticism of the article by Behrend, (noticed in the *Digest*, April 17.) He claims that it contains errors. It is followed by a reply of the author claiming that if the critic will make careful tests he will obtain the same results.

LIGHTS AND LIGHTING.

Projection Arc Lamp.—Lond. *Elec.*, May 14.—A brief illustrated description of the Hepworth lamp; it is fed by hand, this being considered preferable to an automatic feed; the arc is struck by pushing the handle inwards for a moment and then releasing it; the arc is regulated by a simple screw feed; with alternating currents the two carbons are set in line, but their cores are cast eccentrically so as to form two craters in front of the lamp.

Electric Lighting in House Decoration.—Lond. *Lightning*, April 29.—A long illustrated article discussing the decorative lighting of each portion of a dwelling house and accompanied by new designs; this article is made the occasion of a special number of that journal.

Small Arc Lamps.—Zeit. f. Beleucht., April 20.—The beginning of an article on this subject pointing out the well-known advantages and disadvantages of small arc lamps and describing briefly the Naeck and Holsten, and the Niewerth lamps; the chief objection to their introduction is the color of the light.

Electric Lighting. NORRIS. *Sibley Jour.*, May.—A short illustrated article giving briefly some of the chief data and properties of the incandescent and arc lamps; it is a good but brief summary, appearing to contain nothing new.

Artificial Light. JACOBUS. *Elec. Eng.*, May 19.—The beginning of a reprint of the paper which was noticed in the *Digest*, May 15.

POWER.

Local Distribution in Workshops. SCOTT. Lond. *Elec. Eng.*, May 7.—A continuation of his long serial; it consists chiefly of three full page tables giving the data for a large number of installations in Europe and America; the voltage as a rule is from 100 to 120; the high-speed direct-driving engine is gaining ground. A typical installation for, say, 200 horse-power would probably be laid down on the three-wire system with 220 volt lamps; the current will be generated in two large units of 100 hp each direct driven from high speed, enclosed, triple expansion engines; above 15 hp the motors will be run on 440 volts; arc lamps will be run eight or four in series, according to whether they are of the ordinary type or the enclosed type; an accumulator plant will be used for lighting and running the machines at night; single-pole switches will suffice.

Electric Driving of Machine Tools. ROWAN. Lond. *Elec. Rev.*, May 7.—A brief abstract of a recent paper describing the machinery used by a French ship-building company and designed by the author. He seems to refer chiefly to drills which are held to the side of the ship by means of magnets; it appears that the holding magnets and motor together require a current of 13 to 14 amperes at 100 volts; 16 holes of 1 3-16 inch diameter through two thicknesses of three-quarter inch each were drilled by one machine in two hours; one-inch holes were drilled through one-inch steel plates in 70 seconds; with electric drills it becomes possible to drill all the holes for rivets for ships, the expense of which would be prohibitory by any other means.

Automatic Pump Controller. OPPENHEIM. *Zeit. für Elek.*, April 15.—A brief illustrated description of an apparatus for automatically starting and stopping an electrically driven pump which supplies a reservoir. A float in the reservoir operates the necessary switches; it is so arranged that the current for the motor is broken suddenly when the reservoir is full, while at the same time the starting resistance is adjusted for the next start; this resistance consists of a cylindrical vessel with water in which a piston moves up and down, thus regulating the resistance, and plunging into mercury in its lowest position; when the motor is automatically thrown on this piston gradually descends, the speed being regulated by holes bored through it, thus starting the motor gradually.

Electric Plowing.—L'Energie Elec., April 16; abstracted in Lond. *Elec. Eng.*, May 14.—A well-illustrated description of the installation at Enguibaud, which has been referred to in these columns a number of times before; working illustrations of the old and the new form of windlass are given; the plow in this installation is moved by being attached to a cable operated by a windlass; the results of the tests and the cost of the installation are given.

Ventilating Fans. WALKER. Lond. *Elec. Eng.*, May 14.—The beginning of a reprint in full of a paper an abstract of which was noticed in the *Digest* last week; it is accompanied by numerous illustrations, curves and tables of results. Lond. *Engineering*, May 7, publishes an abstract of the discussion, in which some of the statements in the paper are criticised unfavorably; there appears to be no reference to electrical driving.

Aluminum Works at Foyers.—Lond. *Elec. Rev.*, May 14.—A well-illus-

trated description of this large power plant; the description is brief and somewhat meagre. The turbines are of the impulse type and drive the dynamos on vertical shafts; there are five combined sets in position and three more are to be erected; each turbine develops 700 horse-power with a fall of 350 feet; the turbines and dynamos are of Swiss make.

Bellegarde. Preller. Lond. *Engineering*, May 14.—The beginning of a very well illustrated description of this water power transmission plant near Geneva in which a fall of the Rhone is utilized; the illustrations include working drawings and a double page plate.

Comparative Economy of Transmission by Gas and Electricity.—Eng. News, May 13.—An editorial article referring to a Northwestern Electrical Association paper by Perry, read last January, in which he advocated increasing the number of generating stations and decreasing the length of the radius supplied by each, and to use gas engines instead of steam engines, the gas being supplied from one central station; he maintains that it costs far less to transmit the power in the shape of gas than as an electrical current. His arguments are criticised unfavorably, and a number of errors are pointed out which when properly corrected cause an entirely different conclusion to be reached; some of these errors are discussed in detail; there are also other things to be considered, such as the cost of pipe-laying as compared with running a wire, the corrosion of the pipes as compared with the almost absolute indestructibility of copper wire, the costs of the enlargements of the transmission pipes or wires, and the uncertainty of the amount of leakage; in all these conditions the copper wire appears to have the advantage. In conclusion it is thought that it will be a long time before there will be an extensive adoption of Perry's scheme.

Electricity in Mining.—Eng. News, May 13.—An abstract of the discussion of the recent papers by Hale and Brown at a meeting of the Institute of Mining Engineers. Brown pointed out several errors of design which could be avoided; there appears to be an insufficient carrying capacity of the starting resistances used with hoists which are started frequently; the failure of an air cushion at the end of a pipe line also gave trouble, a throb being caused in the pipe by throwing off a motor 12 miles distant; there is insufficient data for comparing the advantages of electricity and compressed air, and he believes that it is not a foregone conclusion that electricity does cheaper or satisfactory work. Bunton has found an economy of 66 per cent. in overbalanced as compared with direct or unbalanced hoists, by overbalancing being meant the balancing of the car and one-half of the live load. Kebler described a case in which work was now done by electricity with five tons of coal, that with compressed air required 35 to 40 tons, but the compressed air plant was not designed to the best advantage.

Riverside. Layman. *Jour. Elty*, May.—A long, illustrated description of the transmission plant for that city in California from the power plant at Redlands; the energy is to be used for both light and power. It is a three-phase system throughout, the current being generated at 2,500 volts and transmitted at 11,000 over a distance of 22.4 miles; the innovation in this system is said to lie in the three transformers of 100 kilowatts each, each of which is a "series combination of two 1,250 to 5,500 volt units, encased in cast iron, oil-filtered, water-jacketed boxes;" it is claimed that there is a higher operating efficiency at all loads than is possible with air-ventilated transformers.

Bakersfield.—St. Ry. Rev., May 15.—A brief but well illustrated description of this long-distance transmission plant in California; 7,000 horse-power are available in a fall of the Kern River; the illustrations are mainly those of the flume, on the top of which a tramway is run; the transmission is at 11,000 volts; very little data are given regarding the electrical features.

Power Transmission Plant in Utah. West. Elec., May 22.—A brief semi-popular description taken from a mining paper. It appears that the plant is under construction and when completed will generate 20,000 horse-power; the fall is 460 feet through a pipe 7 miles long and the energy is to be transmitted 37 miles.

TRACTION.

Jungfraubahn.—Elek. Tech., April 30.—A note stating that owing to the bad weather last year the construction of this mountain railway did not progress as much as was expected; the construction of the large tunnel and other parts will be started this year as soon as the weather permits; the power station, it is thought, will be finished by September, after which electrical energy will be used for the construction of the tunnel.

Mt. Cenis Tunnel.—Lond. *Elec. Eng.*, May 7.—A note stating that an agreement has been concluded for the application of electric traction to the trains in this tunnel; it is intended subsequently to extend the electric traction system down to Turin.

Electric Railways in Austria-Hungary for 1896.—Elek. Zeit., April 29.—Tabular statistics of the fifteen lines in operation covering a total of almost sixty miles of lines or about ninety miles of track; it is the fifth country in Europe with reference to the extension of electric railways.

Surface Contact System.—Lond. *Elec.*, May 14.—A note stating that an accident recently happened on the line in Paris; one of a pair of horses stepped on a section of the conductor and "both" were killed. It was due to the failure of one of the switching devices. A similar accident recently occurred at Munich.

Conduit System.—Elek. Tech., April 15.—A longer report of the test of the Lachmann system, which was referred to in the *Digest* last week.

Traction by Accumulators.—Lond. *Elec. Rev.*, May 14.—A translation of the article from *L'Ind. Elec.*, which was noticed in the *Digest* last week.

Railways.—Lond. *Elec. Eng.*, May 7 and 14.—A brief description of those in Brussels, Rouen, Liege and Paris.

Dover. Stilgoe. Lond. *Elec. Eng.*, May 7.—A reprint of a recent paper, with a large number of illustrations describing the electric railway.

Submarine Boat. Holland system. *Eng. News*, May 20.—A brief description of this recently launched boat, taken from the New York *Sun*. It is to be driven by an electric storage battery weighing 6,000 pounds and capable of furnishing 50 horse-power for 6 hours or 150 for half an hour; there is also a 50 horse-power gasoline engine to be used when the boat is at the surface, the electric motor being used when it is submerged, and it is then capable of developing a speed of 14 knots in a spurt; the guns are operated by compresed air; there will be a crew of five men; air is supplied from cylinders and is exhausted by pumps keeping the pressure inside at 15 pounds to the square inch. Lloyd in the *Elec. Eng.*, May 19, gives a brief description of this boat and the larger one in construction at Baltimore.

Electric Locomotives. Swann. *Sibley Jour.*, May.—A collection of 11 diagrams obtained from the Baldwin Locomotive Works, giving, in the forms of curves, various relations which are of use for making estimates and calculations with reference to heavier electric traffic, such as on elevated and suburban roads; with the aid of these it is claimed any questions regarding power, size of motor, etc., can be determined; they are based on the results obtained by this company, but it is claimed that they are equally applicable to any other reliable apparatus; examples showing their application are given.

Cost per Mile or per Passenger.—St. Ry. Rev., May.—The beginning of a number of opinions of street railway accountants on the question of which of the two units is the best to use. It appears that the widely varying local conditions have very much to do with determining the question.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Automatic Time Switch for Lights and Meters.—L'Energie Elec., May 1.—A illustrated description of a switch which consists of a clock in a securely locked case which can be set to open or close a circuit at any predetermined time; the description does not explain the internal arrangements; it can be used for lighting and extinguishing street lamps or lamps in stores, or to change the reading of a meter when two different rates are charged; it must be wound every 15 days and another form every sixty days.

Automatic Lamp Switch—Lond. *Elec. Rev.*, May 14.—An illustrated description of a simple device for extinguishing lamps at any predetermined time; the current is turned on by a switch which operates a strong spring; the trigger holding this is released by a fine wire solenoid operated by a cheap clock.

Harrow.—Lond. *Elec. Eng.*, May 14.—A long illustrated description of the central station; the continuous-current system is used with accumulators and a double dynamo for supplying the balancing load of the three-wire system; the switchboard arrangements enable the double dynamo to be variously connected with the lines and the accumulators.

Leipzig.—Elek. Zeit., April 29.—An abstract of the report of the operation of that station for the past year.

St. Pancras.—Lond. *Elec. Eng.*, May 7.—The annual report of the operation of this station.

Storage Battery Engineering Practice. Appleton. *Elec. Eng.*, May 19.—In the continuation of his long serial he discusses the methods of installation in isolated plants, referring more particularly to the method of charging; increasing the voltage of the dynamo is not feasible as the battery current is usually only a small portion; dividing the battery into two halves and charging them at the lamp voltage is very uneconomical, but may sometimes be used; the best and most efficient method is to use a small booster in series with the dynamo; this may either be driven by a belt or by a motor and the field should be separately excited from the bus bars; when the battery is used for regulating the load where the service is fluctuating, as when elevators are used, a differential booster is recommended, as this will charge the battery when the load is light and make it discharge when it is heavy; diagrams of the connections for both of these cases are shown.

WIRES, WIRING AND CONDUITS.

Uninsulated Pipe for Interior Wiring. Zingler. Lond. *Elec. Rev.*, May 14.—A continuation of his serial (see *Digest* last week). He shows the importance of a smooth interior, stating, however, that an insulated tube must be much cheaper before it compares commercially with the gas pipe; he shows that the uninsulated pipe system, for equal insulation, is cheaper in first cost and more durable, but if people are willing to pay for the insulated tubing and high-grade wire there is no reason why they should not do so; the best work with gas pipes, including cutting away, wiring and

making good, can be done at about $7.50 per point; he then begins to discuss the important points to be observed in laying out and installing an uninsulated pipe system.

Tubing for Interior Wires. DAVIS and FORBES. *Elec. Rev.*, May 19.—A discussion of the relative advantages and disadvantages from the commercial and engineering standpoints. Although the lined tubing is more expensive than the unlined, the difference is not likely to have an appreciable effect; the lining is undoubtedly an additional safeguard, but it may be an unnecessary one; from the standpoint of strength it would seem that the same thickness of pipe should be adopted as that which is standard for gas pipes; the desired properties of the insulating material are discussed, and the advantages and disadvantages of the two kinds of tubing are compared, the conclusion being drawn that the insulating material used for the lining should be depended upon only for protection; that such lined tube are "the proper thing to-day, but that should tubes be made so that burrs and fins are eliminated with absolute surety, then unlined tubes will become more suitable and will be used. Illustrations of various kinds of tubing are given.

ELECTRO-PHYSICS AND MAGNETISM.

Cathode Rays. J. J. THOMSON. Lond. *Elec. Eng.*, May 7.—An abstract of a Royal Institution discourse; it seems to be a summary of the subject; he adheres to the hypothesis that the rays are due to the violent projection of the negatively charged particles from the cathode. In another abstract, from presumably the same lecture, he states that in the cathode discharge the matter is in something beyond the ordinary state and that the carriers of the discharge in a cathode ray are not atoms but something very much smaller; his conclusions are that the particles carrying the charge must be in a much more finely divided state than the ordinary molecule and pos sibly may be the primordial element; the numerical ratio of the mass of the particle to the charge carried is about 1,100 times less than that de duced electrolytically for the hydrogen ion, showing that either the charge must be very great or the particle very small, and it is the latter which he thinks is the case.

Cathode and Lenard Rays. MCCLELLAND. Lond. *Elec.*, May 14.—A reprint of a Royal Society paper describing experiments; he endeavored to find whether the rays produced by cathode rays on thin filaments carried a negative charge as the cathode rays do; the method is the same as that used by Lenard for testing the charge carried by cathode rays. No gen eral conclusions are drawn; he states that the theory that cathode rays are a stream of charged atoms explains satisfactorily the observed properties of these rays and also the production and properties of Lenard rays.

Black Rays. FRIEDRICH. *Zeit. für Elek.*, April 15.—A short article on what he calls black glass rays or critical rays, which are among those generated by Röntgen ray tubes; they enable living and dead tissues to be distinguished from each other by their permeability; the presence of dead tissues in the living body will therefore be shown; the article consists chiefly of the author's theories involving his new terms, and does not appear to be of general interest.

Pin-Hole X-Ray Photographs. CZERMAK. Lond. *Elec.*, May 14; abstracted briefly from the *Wied. Ann.*, 60, p. 760.—He made photographs of tubes through pin-holes 1 mm. in diameter; such a camera is said to be the nearest available approach of an eye which is sensible to these rays; (the abstract contains no description of these photographs); it is suggested to make a pair of spectacles of lead with a pin hole through each; (this assumes that the retina responds to X-rays).

New Application of Röntgen Rays.—Elek. Tech., April 15.—A note stating that experiments have been made to find whether Röntgen ray tests of coal would give reliable data concerning the amount of ash; it seems that the experiments were a success, although the indication is only an approximate one; the materials making the ash are less permeable; the test could be made by comparing sample slabs of the coal with a piece whose percentage of ash is known.

Residual Charge and Oscillations in Condensers. WULF. *Zeit. für Elek.*, April 15 and May 1.—The conclusion of his very long paper (see *Digest*, April 3, under condensers); it is a discussion accompanied by experimental data. The observed results do not suffice to show that the increased loss of energy with alternating currents is in all cases the result of a residual charge; observations with condensers having no residual charge, have shown no energy; the assumption of the existence of a dielectric hysteresis has therefore not yet been justified by experience.

Law of Dielectrics. HOPKINS AND WILSON. Lond. *Elec. Eng.*, May 7.—A brief abstract from the *Philosophical Transactions* (no date). They made researches with the effect of temperature on the residual charge on the capacity, and on the effect of the residual charge on capacity determinations and on the way in which the properties of an insulator can pass into those of an electrolyte.

Motions of an Incandescent Filament. HOFFMANN. Lond. *Elec.*, May 14; abstracted briefly from the *Wied. Ann.*, 60, p. 642.—A 20-plate influence machine was discharged through a highly exhausted vacuum tube placed near an incandescent lamp through which a current was flowing; the filament is set swinging at every discharge; on the approach of the tube the filament is repelled; whenever the potential is gradually raised and suddenly lowered the motions are observed; a vacuum tube is not necessary; a metallic plate attached to one spark gap terminal, the other being connected to earth, exerts a momentary attraction during discharge; the motion is intercepted by a metallic screen but not by dielectrics; the filament is attracted during charge by ordinary influence; on discharge the filament is attracted by a charged wall; the time required for neutralization is long enough to produce a sensible deflection.

Light Phenomenon with Low Frequency Currents.—Zeit. für Elek., April 15.—A brief abstract from a German physical journal stating that most of the Tesla light effects can also be shown with currents of relatively low frequency from an induction coil; if the capacity of both poles is increased by connecting them with well-insulated brass rings or balls, which may be several meters apart, then in the space between them there is produced an electric field in which Geissler tubes and ordinary incandescent lights become brightly illuminated as though they were directly connected with the poles.

Electrical Trevelyan Rockers. APPLEYARD. Lond. *Elec. Rev.*, May 14.—A brief summary describing six different forms; one of these is a microphone on a resonating box, which will produce a sound when a current is passed through it; another is a tuning fork mounted on a box with a resonating microphone, the magnet operating the tuning fork being in series with the microphone; in another a carbon ball was laid in the angular space between a disc and a ring of carbon, it will move erratically when a current passes; in another a round carbon rod is laid on two others which are horizontal; the movements of this can be made more synchronous by attaching a pendulum to the movable rod.

Earth's Magnetism. BAXENDELL. Lond. *Elec.*, May 14.—An abstract of a paper read before the Liverpool Astronomical Society. He describes experiments made by his father, started many years ago, and shows that the variable period of the cyclic changes are in some way connected with and dependent on the great solar spot period.

Magnetic Researches with Iron and Steel. EGGER. *Zeit. für Elek.*, April 15.—The conclusion of his article on researches with iron and steel made in Austria; a large number of hysteresis curves are given.

Conversion of Electrical Energy in Dielectrics. THRELFALL. *Phys. Rev.*, May-June.—The first half of a very long article in which he first discusses the literature on the subject of the energy in dielectrics and then follows it with a description of his extended researches in this direction; in his experiments he was able to make a condenser in which the heating by alternating currents was practically negligible although the dielectric was merely paper saturated with a mixture of vaseline and hard paraffine; the question which he approached experimentally was whether some of the energy of electrification is converted into heat and if so whether the loss can be explained on the lines suggested by Maxwell and more recently elaborated by Hess; he thinks his experiments lead to the conclusion that Maxwell's explanation is not sufficient in all cases; another question was whether the dielectric loss is a fixed physical property or whether it is an accidental circumstance preventing us from predicting what the loss will be; he appears to have found that it is exceedingly variable in passing from one specimen to another, even when the greatest care is taken to secure uniformity; he also used rapidly varying electric forces by oscillating discharges and obtained the unexpected result that the dielectric losses became either zero or are too small for detection at frequencies of the order of 10 million per second. In discussing the work of others he states that those of Steinmetz are often quoted as proving the existence of dielectric hysteresis, but the present author states that the results are quite fallacious on the grounds of uncertainty of resistance and that the greater portion of the loss was probably due to creeping and air discharges.

Density of Gas and Discharge by X-Rays. CHILD. *Science*, May 21.—A short preliminary article on the effect of the density of the surrounding gas on the discharge of electrified metals by X-rays, a fuller report of which is to appear in the *Physical Review;* he found that the curve given by plotting the rates of discharge as ordinates and the densities of the air as abscissas, did not have the same form under all conditions; his experiments indicate a conduction effect through the gas rather than a convection due to particles thrown off from the discharging plate.

Refraction of Röntgen Rays. WRIGHT. *Science*, May 14.—A brief abstract of a recent paper. Experiments heretofore have been made with prisms, which are liable to lead to errors; he avoided these by using glass and Iceland spar with parallel sides, inclined at an angle of 45 degrees to the rays; a slit and a parallel wire at a considerable distance from it were used; although the image was sharp there was no perceptible refraction. Other experiments were described which offer some support to the idea of true diffraction, but the question must still be regarded as unsettled until secondary maxima and minima are obtained.

X-Ray Picture of an Adult. MORTON. *Elec. Eng.*, May 19. A reproduction of an X-ray photograph of the complete form of an adult taken with one tube on one plate; the distance was 4.5 feet and the total exposure was 30 minutes, including stoppages to allow the tube to cool; an ordinary focus tube was used; the current was broken 5000 times per minute by means of a break wheel; there was a free discharge of sparks across a five-inch air gap.

Harmful Effects of the X-Ray. KOLLE. *Elec. Eng.*, May 19.—A short article discussing the recent one of Tesla (see *Digest*, May 15). He argues

that experimenters should be more free in publishing descriptions of harmful effects, as such descriptions would benefit all; he claims that many mistakes which have been made would not have occurred if the experiments had been conducted by responsible men; apparatus should be carefully studied; a good preventive of injury is an application of vaseline or similar material; the time should be increased rather than diminishing the distance.

ELECTRO-CHEMISTRY AND BATTERIES.

Reaction of Carbon in Electrolysis. Vogel. *Elek. Tech.*, April 30; an abstract of an article from the *Zeit. f. Angew. Chemie.*—A description of extended researches with the reaction of carbon; various different liquids were used; the abstract gives the results briefly. He states that there are no prospects of the solution of the problem of complete combustion of carbon in hydro-electric elements, into carbon dioxide; better results might be obtained with fused electrolytes.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Dielectric Constants. Starke. Lond. *Elec.*, May 14; abstracted briefly from *Wied. Ann.*, 60, p. 629.—A description of a method of determining specific inductive capacities; small plates or fragments of the substance are immersed in a liquid dialectric of the same dielectric constant, which is regulated by mixing liquids until the introduction of the solid produces no alteration; a Kohlrausch-Nernst telephone bridge is used (see *Digest*, March 6).

Method of Measuring Frequencies. Meyer. *Elek. Zeit.*, April 29.—A reply to the criticism of Besso noticed in the *Digest*, May 15; he admits that an experimental calibration of the apparatus is the only reliable method to use.

Most Sensitive Arrangement of Wheatstone Bridge. Child and Stewart. *Phys. Rev.*, May-June.—A short article showing that in special cases there is a better arrangement than that which the usual theory indicates; they refer more particularly to the application of a bolometer. The usual theory states that the most sensitive arrangement is when all the resistances, including those of the galvanometer and battery, are equal, but this assumes an invariable E. M. F.; in practice one is usually limited by the thermal effects in the bridge circuits and not by the inability to secure a larger E. M. F.; this is specially so with a bolometer in which there is a limit to the current; in such a case the current should be treated as a constant and the E. M. F. as a variable; on this basis they show that there was a gain of about 30 per cent. in sensitiveness by changing the resistance from the form commonly used to one where the resistance of the arms not used for bolometer strips is large and a corresponding increase made in the E. M. F.; in their arrangement the battery current passes through the two bolometer strips in multiple, and the two branches in series; with these two strips are made of a relatively high resistance, as, for instance, 100 ohms each, the bolometer strips having a resistance of about 1 ohm each.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Determining the Relative Positions of Cables in a Tank. Taylor. Lond. *Elec.*, May 14.—A detailed description of the Sullivan method which was suggested a number of years ago for determining the relative positions and the top and bottom ends of several cables in a tank. The top cable, the ends of which are always traceable, and the others below it, are treated respectively as the primary and secondary circuits of an induction coil, and the relative positions are determined by the strengths of the current induced in each one, and the order of their ends by the direction of this current. The inducing current is made and broken by means of a key; the induced current will be strongest in the cable immediately underneath the upper one; to avoid error due to the third coil being longer and the current therefore stronger, the induced current is measured first with the ends of all the other cables looped and then with all the ends free; should the primary and supposed secondary be contiguous, the induced charge will be the same in each case, but should a length intervene between them the effect of looping that length will be to diminish the induced discharge in the supposed secondary, the interposed looped cable acting as a screen; having determined the second coil it is used as the primary for the third, and so on. To identify the top and bottom ends a shunted galvanometer is introduced in the primary circuit and the deflection noted; the galvanometer is then connected to the second and the direction noted; from this the top and bottom ends can then be determined if it is assumed that the cables are coiled in the same direction, which is invariable the case; should this not be the case the ends are determined by a method based on the fact that on charging a cable the distant end does not at once assume the full value of the potential, and the induced current must necessarily follow the same law; the induced current is therefore measured at one end and then at the other, the distant end being free in each case; (if the number of ampere turns can be made sufficiently great it might be possible to determine the direction of coiling by the magnetic polarity of the coil); experiments made with a tank of coils are described.

High Speed Cable Laying. Crutchley and Snell.—Lond. *Elec. Rev.*, May 14.—The beginning of a reprint in full with illustrations, of a recent paper describing their proposed system in which a cable is to be laid at the rate of 20 knots an hour; it is simply paid out from a large drum on which the whole cable is coiled, the drum being rotated by steam power. The weak points in the method are pointed out editorially in the Lond. *Elec.*, May 14.

Submarine Telegraphy. Wingfield. Lond. *Engineering*, April 23.—A communication in which he describes, with the aid of illustrations, certain interesting mechanical analogies which were made by Ayrton in his recent lecture on "Sixty Years of Submarine Telegraphy." (Some of the analogies were contained in former references to this lecture).

German-Norwegian Cable. Petersen. *Elek. Zeit.*, April 29.—A translation of an article from the *Telegrafbladet*, describing the system used with this cable: it includes several diagrams.

Railroad Signalling. Ferreira. Lond. *Elec.*, *Elec. Rev.* and *Elec. Eng.*, May 14.—A brief abstract of a recent paper describing the absolute block system devised by him and Pryce and used on the North London railway.

Telegraph Statistics for 1895.—*Jour. Telegraphique*, April 25.—The annual report, consisting of a large number of double page tables.

Telegraph Speed Test.—Jour. Telegraphique, April 25.—A report of the tests made in Belgium recently, and which were referred to in the *Digest* last week.

MISCELLANEOUS.

Stealing Electricity. Ostwald. *Elek. Tech.*, April 15.—A reprint of a short article from a German legal journal. He discusses the question of whether electricity can be classed with other objects with reference to laws regarding theft; he uses the term electrical energy instead of electricity, and maintains that material such as coal must be consumed to generate electrical energy and that the owner or producer loses this equivalent of the energy; it is not a case of *furtem usus*, as the use of the electricity deprives it of its value; energy is in a certain sense just as much an object as ponderable matter on which some work has been performed to make it of value; in the case of compressed air it is not the air which is of value but the energy stored in it when compressed; he concludes that in a legal sense energy in all its forms has properties like ponderable matter which make it of value and its theft should therefore be considered as though it were matter.

Clarification of Wines. Reinke. *Cosmos*, May 8; abstracted briefly from a German journal.—Wine or beer is directly clarified by the sun or by diffused light; when not illuminated it clarifies very slowly; he therefore tried an experiment with an electric lamp, suspending it in the fermenting vats, and found that it produced a complete and rapid clarification.

Air Purifying Apparatus.—Elek. Tech., April 15.—A note stating that the injurious ingredients in air are consumed, and ozone is generated in large quantities, by passing the air near a platinum wire kept glowing with an electric current; it is stated that the German Emperor has two apparatus of this nature in his home; no further description or information is given.

Application of Projectors for Examining the Bottom of the Sea.—L'Eclairage Elec., May 1.—A short paragraph stating that this system was used with great success in finding the fragments of a torpedo; the projector was suspended from a balloon at a height of about 300 ft.; the sea was 60 ft. deep at that place; the experiments are to be continued.

Electrically Controlled Steam Indicators.—Lond. *Elek. Eng.*, May 7.—A brief illustrated description of an electrical attachment for bringing the pencil into contact with the paper at a stated instant; it is of use for controlling indicators when several diagrams for different parts of an engine must be taken at precisely the same instant.

Platinum.—Elek. Tech., April 30.—A brief quotation from an official Russian report. The production of Russia is 40 times as much as that of all other countries together; in 1890 the output was 2,916 kg, in 1894 5,028, in 1895 4,413, in 1896 the output was probably considerably greater than in 1894.

Protection from Lightning. Fraze. Lond. *Elec.*, May 14.—A note from the *Comptes Rendus*, 124, No. 15, calling attention to the extreme rarity of electrical manifestations on Mt. Etna; it is concluded that protection is afforded by the central crater, whose huge cap of smoke and hot air act as a lightning guard.

Charging Open Hearth Furnaces. Head. Lond. *Engineering*, May 14.—A reprint of a recent paper describing the Wellmann charging machine which is electrically driven; the system is in use in this country and is being introduced into England and other countries. The London electrical journals contain brief abstracts of this paper.

Physiological Action of High Frequency Currents. D'Arsonval. *L'Eclairage Elec.*, April 17.—A long abstract of the paper which was noticed in the *Digest*, May 1.

Effect of Franklinization on the Voice of Singers. Moutier and Ganier. *L'Elec.*, May 1.—A reprint of a short Academy note giving the results of experiments which show that the voice becomes more intense, clear and flexible, acquires an agreeable timbre and produces less fatigue.

French Physical Society Exhibition. Raveau. *L'Eclairage Elec.*, May 1.—A long, well-illustrated description of the electrical exhibits at this exhi-

bition, including the Bardon arc lamp, an accumulator regulator, a snap switch, high-voltage fuses, an apparatus for igniting lights at a distance, and an electric heating and ventilating apparatus.

Biographical.—Elek. Zeit., April 29.—A long biography of the late Heinrich von Stephan.

Electromagnet for Eye Surgery.—West. Elec., May 22.—A reprint of a brief illustrated description of the magnet used at the New York Eye and Ear Infirmary; the magnet is about 2 feet long and 3 inches in diameter, the poles, which are at the extreme ends of the straight bar magnet, are brought to sharp points. The metal is first located in the eye by means of a small highly magnetized needle, and is then removed with the aid of this large magnet, except when the particle has penetrated the interior, and then an operation is necessary; the magnet is said to have a "drawing force of 16 pounds" (sic).

Molybdenum free from Sulphur.—Eng. & Min Jour., May 22.—A note stating that experiments by Guichard, reported to the *Comptes Rendus*, show that a metal free from sulphur can readily be obtained from molybdenite in the electric furnace; this is important to the makers of steel; heretofore it has been difficult to secure the metal free from sulphur; when the mineral is heated in a carbon tube with a powerful arc, so that fusion is obtained, the sulphur is entirely expelled.

Lightning Effects. JONES. *Elec. Eng.*, May 19.—A list of nine cases in which shoes were torn off from persons struck by lightning; no explanation is offered.

Calculator. LOW. *Jour. Elty*, May.—A continuation of the description of the Smith-Manifold calculator; it appears to be the concluding article.

Advertising Sign. CLARK. *Elec. Eng.*, May 19.—An illustrated description of a device for showing perfectly formed and spaced letters of different sizes and styles

Book Review.

METODI E STRUMENTI DI MISURA DELLA DIFFERENZA DI FASE FRA DUE CORRENTI ALTERNATIVE. By Riccardo Arno. Turin: Union Tipografico-Editrice. 56 pages. 39 illustrations.

This little book is a very complete summary of instruments and methods for determining phase differences. Written in Prof. Arno's excellent style, it is to be regretted that its appearance in Italian will prevent many students and engineers from availing themselves of its valuable data.

Marine Lighting Equipment.

For the past four years the Rushmore Dynamo Works, Jersey City, N. J., has made a specialty of marine lighting equipment. The most recent production from the establishment is a line of direct-connected engines and dynamos in which every detail has been perfected to meet the most exacting requirements of limited space and cool, quiet running when placed in crowded and overheated engine rooms.

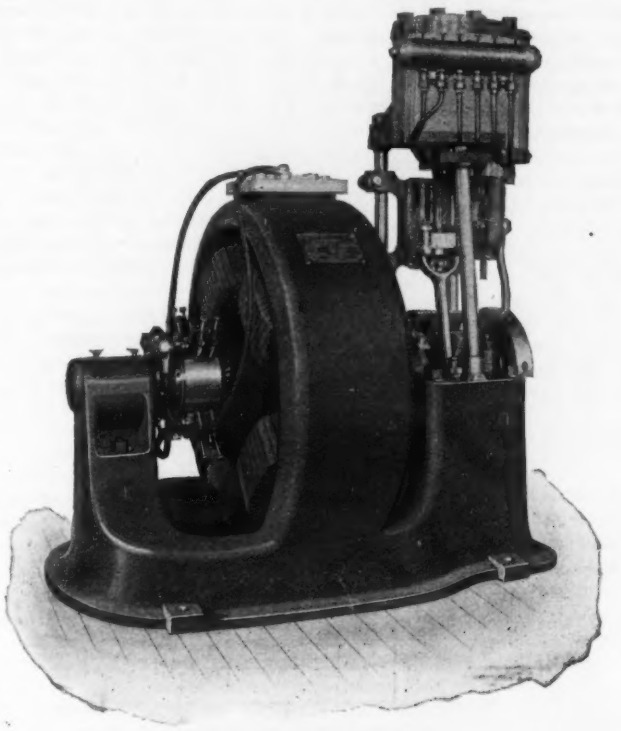
One of the new generating sets of 20 kw capacity at 350 revolutions per minute, with 25-hp engine, is illustrated herewith. The dynamo has but one bearing, which is self-oiling and has a new form of settling chamber, which removes all sediment from the oil. Its frame is extended and carries the

HIGH POWER PROJECTOR.

engine. The armature is of the iron-clad type, wound with a continuous copper bar on a new wave system; is insulated with mica and is guaranteed against short circuit when saturated with sea water.

The engine is coupled directly to the armature-core body, thus ensuring perfect alignment. It is of an entirely new design, and is so perfectly balanced that there is no vibration even when running at double the rated speed. The automatic cut-off governor is very powerful and regulates within 1 per cent. All wearing surfaces are lubricated from a single tank with sight feeds leading to each part.

These machines are designed to meet the exacting requirements of the navy, while the speeds are much lower, and they occupy less than one-half the space usually required for machines of other makes of the same capacity.



MARINE GENERATING SET.

The Rushmore Works also build a complete line of high-power projectors, ranging in size from 10 inches to 72 inches diameter, and taking from five to 250 amperes. They are now building a number of 30-inch naval projectors for the large battleships, with electrical distance-control mechanism. The Rushmore Works claim to have the only lens-making plant in the country, and have recently completed a machine which will grind lenses up to six feet in diameter to within one-ten-thousandth of an inch of the perfect parabolic curvature. A 72-inch light for long-distance signalling, which will consume a current of 300 amperes, will be completed shortly.

A Unique Long Life Arc Lamp.

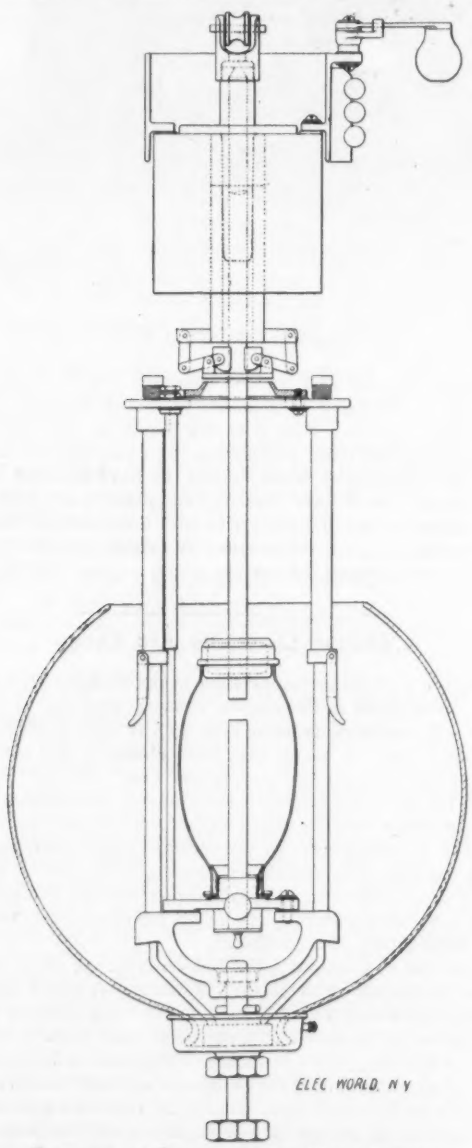
Two elements are of prime importance in the development of the modern arc lamp, a reduction in the carbon consumption and a reduction in length. The first condition is being met by the now generally used arc-enclosing globes, but it is rarely that both elements are combined with such particular skill and ingenuity as in the new "Unique" long life arc lamp recently put on the market by the General Incandescent Arc Light Company, New York City. In this lamp not only is the carbon consumption decreased to a minimum, but the actual height from tip to tip may be said to be the length of the two carbons placed end to end. So ingeniously and simply has the mechanism for performing the various essential functions been arranged that the entire combination produces a most efficient and satisfactory combination.

Designed for use on constant potential circuits, the lamp burns singly with a current consumption of about 5 amperes. A single trimming with 12 by 7-16 inch upper and 5 by 7-16 inch lower solid carbons results in a life of from 100 to 125 hours. Fully equipped with such carbons the extreme length of the lamp is but 28 inches. The lamp is finished in a bright brass upper casing surrounding the resistance and mechanism and abutting the outer globe at the lower end, making an entirely spark-proof casing and giving the lamp an exceedingly symmetrical and compact appearance.

The inner bulb enclosing the arc is made of either clear or alabaster glass and is screwed at its lower end to the bulb seat in the cross bar from the two side supporting rods. The method of fitting the threaded bulb holder to the lower end of the bulb is most ingenious and will readily be seen from the illustration. The upper cap on the bulb through which the upper carbon passes centrally is an iron casting fitting the top of the glass and has its upper side coned so as to exactly fit the conical seat in the lower side of the mechanism base plate, when pushed up in position for operation. This is a departure from general practice, as usually these caps in enclosed arc lamps are allowed some movement for a proper align-

ment of the carbon, but in this lamp superior effects have been found to result from a rigid holding of both bulb and cap. The lower carbon is held in the lower end of the previously mentioned bulb seat bar. The upper carbon is entirely free from carbon rods, simply passing through the opening in the bulb cap, and is clamped at its upper end in a short cylindrical clamp rod which is used to add weight to the carbon and permit of its almost entire consumption, feeding until stopped by the rod striking the top of the cap.

For feeding and regulating the operation of the lamp, a single concentrically placed series solenoid coil is used, acting on a hollow iron core, which surrounds the upper carbon. The latter when full length extends upward through the coil into a supporting tube fastened to the upper part of the mechanism frame. Oppositely fastened to the lower end of the hollow iron core are two short studs, at the outer end of which are attached the operating levers for the clutch mechanism which acts directly on the carbon. The clutch is of the duplex-balance grip type, and will readily be understood by reference to the illustration. When lowered so that the weight connected to each of the clutch shoe levers centrally pivoted thereon rests on the stop block on the lower base, the clutch shoes are thrown upward, releasing the carbon for feeding. As the core is drawn into the solenoid the weight pulls the shoes down against the sides of the carbon, which is then gripped and pulled upward to form the proper arc. In order to produce a sufficiently gradual movement the core is arranged to act as a dash-pot piston acting in the coil spool whose upper end is closed and has a downwardly projecting tube through which the carbon passes between the latter and the core. A noticeable feature is the entire absence of springs

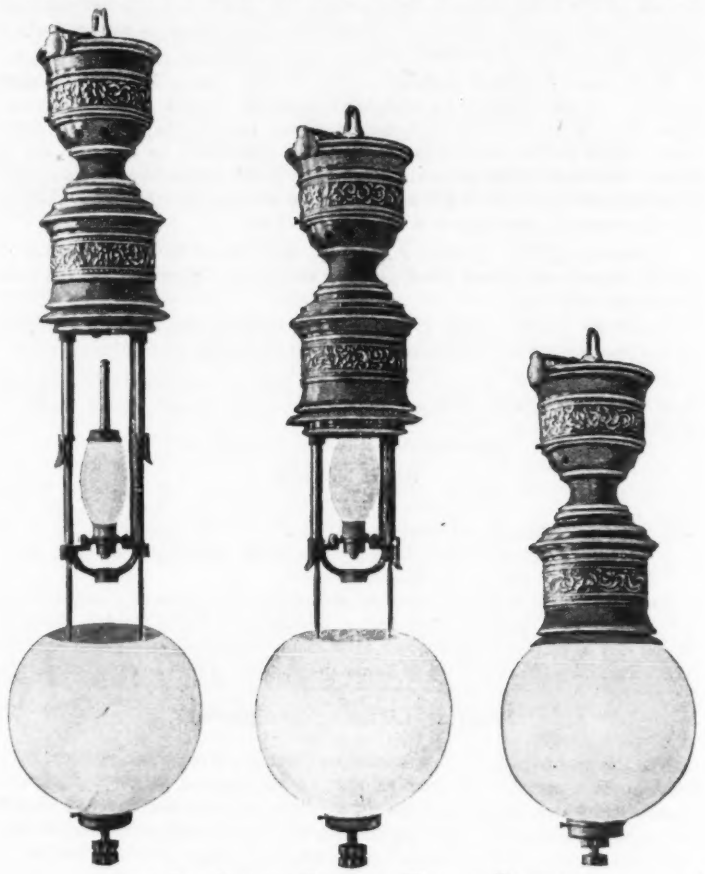


Details of Lamp—Globe Half Down.

and devices which are in any way liable to require attention or frequent adjustment.

Probably equally unique with the operating mechanism is the ingenious arrangement for supporting and lowering the outer globe for trimming and cleaning. In each of the two side rods are telescoped two others. The inner smallest rods are fastened at the lower ends to the globe-supporting cup, which is centrally fitted with a latch arranged to co-act with an opening in the cross bar connecting the two central rods. After being lowered the globe is raised half way for trimming, by telescoping the smallest rods into the central rods, and is held in this position by turning the latch in the opening in the cross bar. Then the central and telescoped inner rod and globe are both pushed upward until the central rods are caught on each side by a latch fitted to the outer rods, and the globe is then in its proper operating position. When lowering the globe, the latch in the globe cup is first operated and then the two side latches. Both operations can easily be accomplished with one hand. By means of the simple globe and bulb detaching devices, the cleaning and trimming of the lamps is reduced to the greatest simplicity. In trimming, it is only necessary to unclamp the lower carbon and then detach the other from its clamp rod and allow it to fall through the same opening.

The resistance is in the form of a coiled wire wound around the



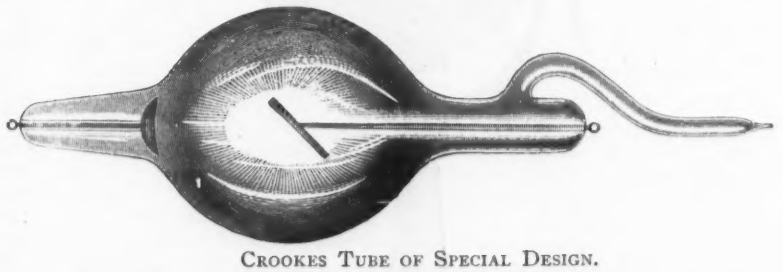
New Arc Lamp.—Globe in Various Positions.

upper end of the supporting rod on porcelain insulators. An excellent feature in this part of the apparatus is the ability to vary it by plugging out portions thereof in order to conform to the exact voltage on which the lamp is to burn.

When it is desired to obtain the maximum light and minimum height, the outer globe is dispensed with and in its place an opalescent reflecting shade is used fastened to the lower part of the casing, so arranged that the lamp only measures 24 inches.

A Large Size Crookes Tube.

We illustrate herewith a large size Crookes tube, manufactured by the Swett & Lewis Company, successor to G. A. Frei & Co., Boston, Mass.

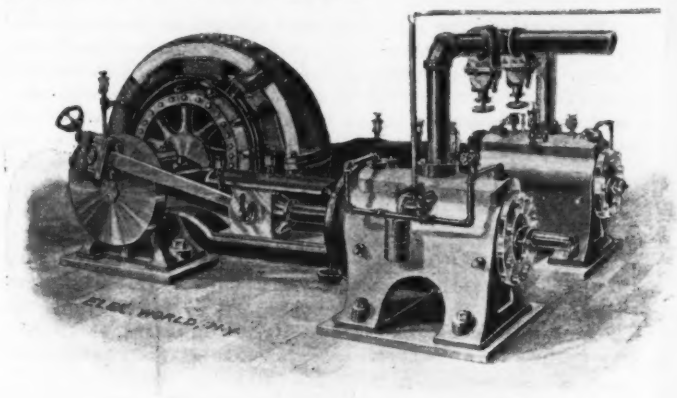


Crookes Tube of Special Design.

The tube has been specially designed by a leading physician for use on large static machines and induction coils, and will easily cover a 16-inch x 20-inch plate. The electrodes are so placed as to get the full benefit of the rays. When desired the terminals can be furnished with metal caps to protect the wires. Many hospitals are availing themselves of this large tube, which, when used in connection with the company's new adjustable spark-cap, will give at least 25 per cent. increased brilliancy. Besides giving a greater volume of light the large tubes do not run up in vacuum, as do the small ones, and will last longer.

Electric Air Compressor.

The Walker Company, Cleveland, Ohio, has given considerable attention to special applications of its apparatus, and one of the most recent is the electric air compressor illustrated herewith. In mining districts where the country is mountainous, there is almost invariably a water right within a short distance from the mine. It is therefore possible to transmit power to the mine for the operation of locomotives, hoists, etc., and for the compression of air. The machine illustrated represents the adaptation of one of the Walker Company's large slow-speed motors direct-connected to an Ingersoll-Sargeant duplex air compressor. The direct connection of the two elements of the combination avoids the mechanical losses and the question of the intermediate gearing involved in the more conventional

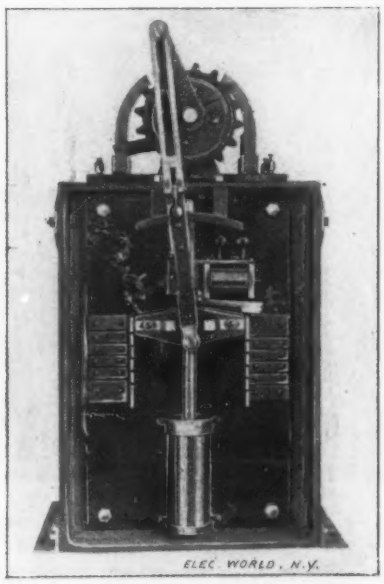


MOTOR AND AIR COMPRESSOR COMBINATION.

methods. The direct connection is desirable on account of its extreme simplicity, and in the case illustrated, presents a very substantial appearance. The arrangement of apparatus is most compact.

A New Elevator Controller.

A front view of a new rheostat designed for the control of electric elevators is shown herewith. This device, which is the product of the American Rheostat Company, Milwaukee, Wis., possesses some features that entitle it to the careful consideration of those interested. The switch is so constructed as to snap closed or snap open, thereby avoiding the evil results that ensue from a partially open or partially closed switch. When it opens it does so fully and positively, and any slight variation in the pull of the cable by the operator has no effect on the proper action of the switch. In operation it is said to be practically sparkless, notwithstanding the fact that it cuts out the shunt field circuit as well as the armature.



NEW DESIGN OF CONTROLLER.

The rheostat brushes pass over the contacts as rapidly as the regulation will permit, and the operator can in no manner force them over at a greater speed. He can, however, bring back the brushes as rapidly as he desires.

The regulating magnet stays the movement of the rheostat arm when the current exceeds a given value, and thus prevents the further elimination of resistance, which would result in a rush of current. This device is really the safety valve of the system and avoids the danger of damage to the motor consequent upon the overloading of the elevator. When the elevator is not in use the current is entirely cut off, and this cutting off is accomplished without any arcing at the switch.

This rheostat, it is stated by the manufacturer, requires a minimum of attention, and in the operation gives thorough satisfaction. In its construction careful attention has been given to details.

Electric Light in a Cement Quarry.

An interesting electrical installation has recently been made in the quarries and mills of the F. O. Norton Cement Company, at Binnewater, N. Y., situated in the Rosendale cement district, about seven miles from Kingston.

The electric plant consists of a 30-kw alternating-current incandescent dynamo, manufactured by the General Electric Company, as in fact are the lamps and wiring devices of which the plant consists. This machine is driven by a 10 × 12 horizontal automatic Ball engine.

There are now installed 103 incandescent lights, lighting the kilns shed, where the calcined product is taken to the crushers, the mills, the packing rooms, the shipping rooms and various other departments of the factory.

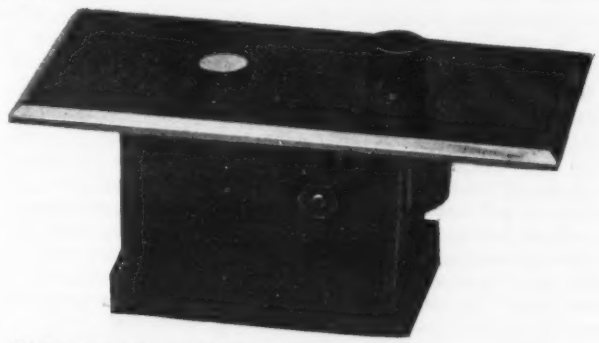
The quarries are lighted by 40 incandescent lamps and 14 arc lamps. The current is used at a pressure of 300 volts, being reduced by transformers to the necessary voltage for arc and incandescent lamps. Each arc lamp is operated by its individual transformer. In addition one or two incandescent lamps on flexible cords, protected by wire cages, will be operated from the same transformer where particularly close light is required.

Arc lamps are also connected by flexible cord to the transformers. The circuits are carried into the quarries from the power house a distance of about 400 feet in one direction and 1,500 feet in the other. They are carried along the galleries and fastened to insulators fixed to plugs driven into holes in the roof of the worked-out galleries. From various points main loops are carried to the galleries where the work is going on.

The manager and engineer states that no considerable difference can be detected in the amount of coal used since the introduction of electricity, and is fully satisfied that it costs no more than they were obliged to pay each month for oil under the old method. Besides, the amount of work which can be done by means of electric illumination is greater, while far more easily performed.

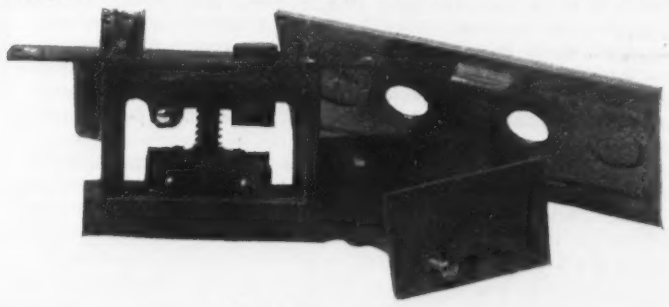
The "New England" Push-Button Switch.

Push-button switches are growing in popularity, and being out of the way, convenient, and presenting a neat appearance, they are preferable to the ordinary switch. Such a switch, however, should be strong, substantial, safe and not liable to get out of order, for, being built into the wall, it cannot be readily taken out for repairs without injury to the plastering, etc.



PUSH-BUTTON SWITCH.

The "New England" push-button switch, which is illustrated herewith has just been brought out by the O. S. Platt Manufacturing Company, Bridgeport, Conn., after much study and search for all of the weak



ELEMENTS OF SWITCH.

points in switches. It is claimed to be well-nigh perfect, and cannot be broken by any ordinary use and cannot get out of order. It is made of metal, excepting a slate base, and is perfectly insulated. It has positive and quick movements, which will be readily appreciated by all who have found trouble with other switches.

Lamp Company's New Home.

Less than a year ago the Lynn Incandescent Lamp Company introduced itself to the electrical trade, at a time when, owing to business depression, it required no little energy and pluck to do so. There was, however, one strong point in its favor, which was the unfortunate condition and low prices in the incandescent lamp business, which it claimed not only to be able to meet, but also, by its peculiar process of lamp renewal, to furnish the trade with a cheaper and even better lamp. The company started in

Sorting Room.

very small quarters, which it speedily outgrew. To-day it can boast of a magnificent and spacious new home at 685 Washington Street, Lynn, Mass., of which it has every reason to be proud, possessing as it does ample facilities for taking care of almost any increase in its already large lamp output.

The factory is centrally located and occupies a space of 10,000 square feet, abundance of room and excellence of light being afforded.

As is well known, the business of the company is confined solely to the renewal of worn-out filaments. A brief reference to the successive stages in its process of lamp renewals will undoubtedly be of especial interest, emphasizing as it will a completeness of detail and care which explains fully the wonderful growth of the business of this company. The lamps are received at one division of the factory and proceed without interruption through the various operations to the stock and shipping department. After the lamps have been received, unpacked and set in racks holding 50 each, they are delivered to the first operator, who examines them carefully and rejects those which have lost their vacuum through any imperfection, thus preventing any liability of renewing a lamp which is burned out because of a leak in the bulb. This fact alone, it is claimed, places the life of a given number of renewed lamps far beyond the reach of new lamps.

The next process consists of sorting the lamps into various sizes, to enable them to be fitted with a shape and length of filament which will give them a good appearance. The next process is the removal of the tips, and through the small holes thus formed a set of operators withdraw the filaments, and, with a dexterous twist of the hand, insert new ones, which are then carefully cemented to the platinum tips. It is extremely important to obtain the right kind of cement, and the company employs a kind specially prepared, which has stood the test for many years. This cement really makes possible the company's entire renewal process. It is very strong, is a good conductor, will withstand a high temperature, and does not throw off the gas which makes most paste joints objectionable.

The next operation is to remove the black deposit on the inside of the glass by slowly revolving the bulb through the flame of a large gas burner. Then follows the attaching of a small tube to the end of each bulb, precisely as in the manufacture of new lamps. The exhaustion of the lamp, which is a most important step in the process, then claims attention. The pumps are mechanical, specially designed by the company's expert, and give extremely satisfactory service. In order to obtain the best vacuum the lamps are exhausted one at a time instead of in large lots, the operator's attention being given till the lamp is finished, after which it is sealed, thus producing by this latter operation an exact counterpart of the tip of a new lamp.

In the splendidly equipped photometer room each lamp is tested, first for vacuum and then for its candle power, voltage and efficiency, and those not up to standard are quickly rejected. The lamps are finally tested by being run at the required voltage and having the filament carefully examined for proper contour. After being washed and labeled the completed lamps are ready for shipment.

The filaments used by this company have a very high specific resistance, which necessitates a very heavy treatment. It also secures a uniformity and extreme durability which, it is claimed, are unexcelled.

The whole system reflects a great deal of credit upon the manager of the company, Mr. E. F. Dwyer, who has had long experience in incandescent lamp manufacture.

Testing Room.

An Economical Lubrication.

By no means the least important element in the operation of electrical power machinery is the proper lubrication of the moving parts. Thereon depends not only the efficiency of transmission from the prime mover, but also to a great extent the economical and cleanly operation of the entire plant. The use of oil for this purpose is sometimes open to objections, owing to the fact that it is easily thrown from the rotating parts onto the surrounding machinery and floors, causing not only a waste of lubricating material, but also an uncleanly condition of the plant, and at the same time increasing the fire risk.

Various greases have been compounded to displace liquid oils for lubricating purposes. Such lubricants, however, are also beset with almost an equal number of objections owing to the fact that the heat produced in the bearing melts the ordinary grease, thereby causing very much the same condition of affairs as with ordinary oil lubrication.

A new lubricating compound has for some time been exploited by the Kent Lubricant Company, whose New York and New Jersey agent is the New York & New Jersey Lubricant Company, New York. This lubricating compound or grease will not melt below a temperature of 350 degrees Fahr. It is largely composed of light mineral oil chemically united with tallow, giving it the required viscosity and softness. In most other lubricating greases, the lubricating elements are usually united by some resinous material. In the new Kent grease, however, such a uniting element is entirely omitted, and the two lubricating materials, of which the grease is largely composed, light mineral oil and tallow, are united by a peculiar process which makes the finished grease entirely free from the objections inherent in those using a resinous uniter.

Owing to the fact that the better the lubricant used less heat is generated in the bearing, and therefore the slower the destruction of the lubricant, this grease will wear longer and with less waste than where ordinary greases are used. For its application an exceedingly simple pressure feed cup is used.

It is claimed that by the use of this material a saving of nearly 50 per cent. can be obtained over other methods, owing to the above-mentioned features. Amongst the prominent users of this lubricant in New York are the Interior Conduit & Insulation Company, the De la Vergne Refrigerating Machine Company, the Metropolitan Street Railway Company, the New York *Herald*, Harper Brothers, J. L. Mott Iron Works and many other well-known concerns. It may also be added as a matter of interest, that all the journals in the great Ferris wheel at the World's Fair in Chicago, 1893, were lubricated with this compound, and gave complete satisfaction in the operation of that unique structure.

NEWS OF THE WEEK

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, May 24, 1897.

ELECTRICAL STOCKS were quiet, no marked changes in quotations being recorded in any instance. The prices in general are practically the same as they were when we closed our last report.

TELEGRAPH AND TELEPHONE.—General dullness prevailed in this list during the past week, and the changes in quotations were very slight, the most marked being American Bell, which dropped 2 points. All other variations were merely fractional.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked.
Chicago Edison Company	100	110	..
Edison Electric Ill., New York	100	111½	115
Edison Electric Ill., Brooklyn	100	105	..
Edison Electric Ill., Boston	100	147	148
Edison Electric Ill , Philadelphia	100	..	..
Edison Ore Milling	100	7½	10
Electric Storage Co., Philadelphia	100	17⅞	18¼
Electric Storage, pref	100	19	20
General Electric	100	30⅛	30½
General Electric, pref.	100	66	70
Westinghouse Consolidated, com	50	21½	22½
Westinghouse Consolidated, pref	50	50	51
BONDS.			
Edison Electric Ill., New York, con. 5s	105	112	..
Edison Electric Light of Europe	100	75	85
General Electric Co., deb 5s	100	97½	98
TELEGRAPH AND TELEPHONE.			
American Bell Telephone	100	230	231
American District Telegraph	100	.	35
American Telegraph and Cable	100	..	89
Central and South American Telegraph	100	124	127
Commercial Cables	100	150	..
Erie Telephone	100	65	..
New England Telephone	100	106¼	108
Postal Telegraph Cable	100	97	..
Western Union Telegraph	100	77¼	77⅞
ELECTRIC TRACTION STOCKS.			
Baltimore Traction	25	19⅜	19½
Brooklyn Rapid Transit	..	19¼	20
Brooklyn Traction	100	..	14
Brooklyn Traction pref	100	46	48
Buffalo Street Railway	100	69	71
Cleveland Electric Railway	100	..	.
Columbus Street Railway	100	43	45
Hestonville	100	49½	50
Hestonville, pref	..		62½
New Orleans Traction	100	6	8
New Orleans Traction, pref	100	26	28
North Shore Traction	100	19	21
North Shore Traction, pref	100	75	78
Rochester Street Railway	..	10	13
Steinway Railway	..	45	50
Union Railway (Huckleberry)	..	..	103
Union Traction, rcts $10 pd	..	12¾	13
West End, Boston	100	76	77
West End, Boston, pref	100	91¼	92
Worcester Traction	100	11	13
Worcester Traction, pref	100	..	91
BONDS.			
Brooklyn Rapid Transit 5s, 1945	100	75⅜	..
Buffalo Street Railway 1st con. 5s	100	*106½	108½
Cleveland Electric Railway 1st mtge., 5s	100	103	105
*Columbus Street Railway 1st 5s	100	94	96
Rochester Street Railway 1st 5s	100	..	100
Union Railway (Huckleberry) 1st mtge. 5s	..	105	107
*Westchester Electric 1st mtge. 5s	100	100	103

*With accrued interest.

ELECTRIC TRACTIONS.—Street railway shares showed a weaker tendency during the week just closed, and in most all cases the changes, although fractional, were downward.

A FOUR PER CENT. SEMI-ANNUAL DIVIDEND.—The West End Street Railway Company has declared a semi-annual dividend of 4 per cent on its preferred stock, payable July 1.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, May 27, 1897.

OFF FOR EUROPE.—Mr. E. J. Wessels, general manager of the Standard Air-Brake Company, will sail for Europe on June 2, on the steamer "Majestic," in the interests of the company.

MR. ELIAS E. RIES is now permanently located at Room 1031, Temple Court, Beekman Street. Mr. Ries is devoting his entire time and attention to consulting and electrical expert work.

MR. F. H. SHEPPARD has taken the agency for the S. E. I. Company, Syracuse, N. Y., manufacturer of switchboard instruments. Mr. Sheppard's office is on the sixth floor, No. 39 Cortlandt Street.

IN NEW QUARTERS.—Hamerschlag & Co., electrical manufacturers, have removed from 26 Liberty Street to 100 Maiden Lane. Under the supervision of Mr. Arthur A. Hamerschlag the concern is increasing its business, and has recently developed a number of new devices.

ELECTRIC POWER ON A BROOKLYN "L" ROAD.—It is reported that the Kings County Elevated Railroad in Brooklyn will be equipped with electric power, after the reorganization of the company has been effected. The system to be adopted, it is stated, will be the "unit" control system of Mr. F. J. Sprague.

TEST OF AUTOMATIC MOTOR STARTING BOXES AND CIRCUIT BREAKERS.—On Wednesday afternoon, June 2, a test will be made at the Twelfth Street Edison station of various automatic over and under-load release motor starting boxes and magnetic circuit breakers. The test will be under the supervision of the Edison Illuminating Company's engineering staff, and will be witnessed by representatives from the Underwriters, Fire Department and other inspection bureaus, and also by all parties interested. All manufacturers of such apparatus have been invited to submit their apparatus for test, and judging from the arrangements which have been made a thorough and most comprehensive examination will be made of each. Such apparatus is required by the rules of the New York Fire Department Inspection Bureau with all electric motor apparatus above 1 horse-power.

TO DEVELOP TRADE WITH MEXICO.—A novel idea, having for its object the stimulation and encouragement of trade between the United States and Mexico, is to be carried out in concrete form this year. The United States Trades Exposition proposes to dispatch an exposition train from New York City on or about August 1, next, to make a tour of Mexico, the trip covering a period of six months and a distance of over 10,000 miles. The object of this enterprise is to introduce to the Mexican jobber, trader and consumer articles of American manufacture by exhibiting them in the exposition train, to which the public will have free admission. The enterprise is indorsed by the National Association of Manufacturers of the United States of America and Government officials of the United States and Mexico. The office of the United States Trades Exposition is at 413 Temple Court, New York City.

LARGE NEWSPAPER PRESSES OPERATED BY ELECTRIC MOTORS.—A very interesting application of large electric motors to the direct operation of newspaper printing presses has recently been made by the Bullock Electric Manufacturing Company (formerly the Card Electric Motor & Dynamo Company), Cincinnati, Ohio, at the printing rooms of the New York "Journal." Two sextuple Hoe color-printing presses are each separately operated by a large ironclad motor directly geared thereto. The motor is suspended on the ceiling beneath the press-room floor, and is handled by means of regulating apparatus located almost immediately above it on the side wall of the press room, opposite each press. Many difficulties had to be overcome in order to make the application of an electric motor directly to a printing press of this type commercially and economically operative. One of the conditions which had to be met was to permit a press-cylinder movement of even an inch or less at a time, and run at one-twentieth speed, which is necessary when the sheets are first fed in starting the press. The motor used is of the standard type, built by the Bullock Electric Manufacturing Company, and specially designed for heavy duty work. A variable voltage system is employed to give the desired speed and torque

effect. Similar installations are also being made for the New York "Herald," New York "Sun," San Francisco "Examiner," Chicago "Journal" and Toronto "Globe."

THE FIRE AT THE WARD LEONARD ELECTRIC COMPANY'S FACTORY.—In the last issue of The Electrical World a brief reference was made to the destruction by fire of the factory of the Ward Leonard Electric Company, Hoboken, N. J., on the night of May 20. We have since obtained some particulars of the disaster. The fire began between 7 and 8 o'clock, but the company was enabled to save all of its books, records, data, and other property of importance, by reason of the fact that it was running its factory night and day, on account of having a large and increasing volume of business. Within forty-eight hours after the fire the company had leased a new factory building at the corner of Seventh and Clinton Streets, Hoboken, which has ample facilities and is equipped with a first-class electric power plant. While the fire was in progress the company placed orders for tools and supplies for the commencement of business in its new factory. The new factory is now running with a full force. The company was well insured. On account of the preservation of the records, the company's customers will not experience any embarrassment in securing promptly duplicates of any rheostats which have ever been made by the company. The company does a very large business of a special nature for various electrical concerns.

A NEWSPAPER PLANT SUPPLIED ENTIRELY FROM CENTRAL STATION SERVICE.—The new building owned and occupied by the New York German "Herold," 22-24 North William Street, furnishes an excellent example of the increasing field for central station current supply. This building is equipped with about 1000 lights, two electric elevators, probably 50-hp in motors located at the present time on the different floors, and two 40-hp motors operating large perfecting presses used for printing the paper, making an aggregate consumption at the present time of nearly 400 horse-power. This will probably be increased to about twice this amount in the near future. The entire current supplied for this building is furnished by a double street service from the New York Heat, Light & Power Company's station. The "Herold" Building cuts through the block from North William to William Street. A separate service is brought in on each side and thence to the switchboard located centrally in the basement. The system of distribution used by the New York Heat, Light & Power Company is of the equalizer three-wire type, the service mains being 220 volts, which is used direct on the various motors throughout the building, while for lighting purposes an equalizer dynamo is used with a centrally-tapped neutral wire, giving 110 volts on each side thereof, for lighting purposes. In wiring the building the Brooklyn Electrical Equipment, who had the matter in hand, provided an ample carrying capacity in all cables, and it is interesting to note that the placing of the main feeders from the service to the switchboard required about fifteen men.

New England Notes.

Branch Office of The Electrical World,
Room 91, Hathaway Building, 620 Atlantic Ave.,
Boston, Mass., May 24, 1897.

NEW KNIFE SWITCH.—The Hope Electric Appliance Company, Providence, R. I., has just issued a very neat and artistic circular containing an illustration and description of its new instantaneous make-and-break safety knife switch.

RÖNTGEN RAY SPECIALTIES.—The Swett & Lewis Company, successor to G. A. Frei & Co., Boston, has made some very gratifying sales of X-ray outfits. Arrangements have been just completed whereby one of the large photographic supply houses, and also a leading surgical instrument dealer, both of New York, will handle the company's X-ray specialties.

IN LARGER QUARTERS.—The Ansonia Electrical Company, Ansonia, Conn., since the addition to its factory, is certainly housed most comfortably, so far as its executive offices are concerned, and in their respective quarters Vice-President and General Manager Wallace, Secretary Platt and Treasurer Anschutz appear perfectly at ease and contented with their "happy lot." The addition and improvements which have been made to the factory of this company are especially noticeable. It now stands three stories in height, affording the much-needed extra facilities which its growing business has been exacting for a long time. The demand for the company's well-known wire products and electrical specialties is rapidly increasing. In the ground enclosure in front of the factory is located a band concert stand—a possession which does not fall to the lot of the average wire manufacturer. Altogether, the plant now presents a neat appearance, and the company deserves the congratulation of its friends and patrons.

THE ELECTRIC POTENTIAL held its last meeting of the season at Hotel Thorndike, Friday evening, May 21. It was a very enjoyable affair, there being about fifty members and invited guests present. After an excellent dinner had been served, each gentleman was presented with a cigar, inclosed in a neat envelope, and President Edmund H. Hewins, in a graceful speech, introduced Hon. Geo. G. Crocker, chairman of the Boston Transit Commission, who delivered a very interesting lecture on the "Subway and Its Relation to Municipal Rapid Transit." After briefly touching upon the change of motive power on the street railways of Boston from horses to electricity in 1888, the speaker described the condition which necessitated the building of the subway, and the audience was treated to some illustrations of the various methods of construction of the subway, which it was found necessary to build so that crossings would be avoided. The speaker concluded with a picture showing the relative sizes of the tunnels, either built or in process of construction, in the principal cities of the world, and illustrating very clearly the magnitude of this undertaking. The president next introduced Mr. Roger W. Conant, electrician of the West End Company, who spoke on the electrical equipment of the subway south of Park Street, which is to be the portion used during the present year. Mr. Conant stated that the power to be furnished was direct current at a pressure of 500 volts, and was to be supplied from the Albany Street power house. In order to shorten the length of the feeders, two underground conduits were constructed, one on either side of the tunnel, and each containing a series of six ducts; the manholes were built of cast iron every 400 feet apart. Thirty tons of copper were employed in the feeder system, entailing a loss of only 6 per cent. in the power supplied. During the winter months 800 horse-power will be necessary, which will be decreased to 450 horse-power during the summer season; of this 60 horse-power will be consumed in lighting and 40 horse-power in driving the ventilating fans. The stations are to be lighted by arc lamps placed five in series, while the tunnel will be illuminated by 16-cp lamps, likewise placed five in series, spaced 12 feet apart, and connected on alternate circuits. In the double-track tunnel there will be three rows of lamps, and in the four-track portion six rows of lamps. The lighting circuits will be run from a special feeder, to overcome any unsteadiness that would otherwise occur. The rails have been laid upon wooden ties, which were treated with a preservative, and the insulation resistance is 40 ohms per 1000 feet. The speaker closed with a description of the thorough bonding of the entire structure, to prevent electrolysis. Mr. C. H. Hile, also of the West End Company, was the next speaker, and gave a description of the mechanical equipment of the railway. He stated that after carefully considering the three-rail system, it was finally rejected in favor of the trolley. The aim has been to utilize wherever possible the standard apparatus in use by the company, as it is the best to be procured. The cross-section of the trolley is in the form of a figure 8, and is of such a size as to accommodate the present trolley wheel. Owing to the small amount of head room, a very short and carefully insulated hanger has been used, which in turn is attached to a wooden trough suspended from the I-beams by toe clips. In straight-line work the hangers are spaced every 12 feet, and on curves every 6 feet. T-rails weighing 85 pounds to the yard have been laid, with a wheel-guard weighing 41 pounds to the yard bolted to it; the rails are joined together by continuous rail joints, and are bonded with the so-called West End bond, consisting of 0000 iron wire, having a steel pin soldered at each end.

Pittsburg Notes.

Pittsburg, Pa., May 24, 1897.

ENGINEERS' SOCIETY MEETING.—The regular monthly meeting of the Engineers' Society of Western Pennsylvania, held on May 18, was one of more than usual interest. The speaker was Mr. Henry W. Fisher, electrician of the Standard Underground Cable Company, and his subject was "Electric Currents of High Frequency and X-Rays." Mr. Fisher has devoted a great deal of time to high frequency and Röntgen ray investigations, and is an authority on these subjects. His many experiments and the explanations of them were therefore followed with close and interested attention by the members of the Society. Among other things the lecturer showed how inflammation of the skin from exposure to Röntgen rays could be prevented by the use of an aluminum screen.

NEW TROLLEY COMPANIES CHARTERED.—Three charters were issued on May 20, at Harrisburg, for street railway companies to operate in the vicinity of Pittsburg. The West End, Mt. Washington & Banksville Street Railway Company, with a nominal capital of $12,000, was chartered to build a line from the present terminus of the West End Traction Company's tracks in the Thirty-sixth Ward, Pittsburg, to Banksville, a distance of one mile, with a branch up Mt. Washington to Virginia Avenue and Kearsarge Street. The Carnegie, Heidelberg & Bridgeville Street Railway Company, capitalized at $30,000, was chartered to construct a line from Carnegie through Heidelberg and Woodville to Bridgeville. The incorporators of both of these companies are men identified with the Second Avenue Traction Company, and the routes described in the charters show that both of the proposed roads will be extensions of the Second Avenue Company's great system. It is asserted that these roads will be built at once, and that they will be in operation by October of this year. The third charter granted was for the McKeesport, Monongahela & Findleyville Street Railway Company, for a road along the Monongahela River between Dravosburg and Monongahela City, with a branch 2¾ miles long to Findleyville. The incorporators of this company are J. L. D. Speer, Joseph H. Moore, M. M. Bunting, David Jenkins and William R. Rowe. The capital stock is given as $10,000.

Chicago Notes.

Branch Office of The Electrical World,
936 Monadnock Building,
Chicago, Ill., May 24, 1897.

THE TABLES TURNED.—It is stated that the Western Telephone Construction Company, Chicago, has brought suit against the American Bell Telephone Company, et al., for the alleged infringement of Patent No. 581,350, taken out by Mr. J. E. Keelyn on a telephone receiver, now owned by the company first named.

MESSRS. H. M. UNDERWOOD & CO., Chicago, Ill., have just been appointed the Chicago agents for the Belknap Motor Company, Portland, Me. Mr. H. M. Underwood has been in the electrical business since 1884, and has been connected with many of the largest electrical companies. The Belknap Motor Company may be congratulated in obtaining the services of such an enterprising person as Mr. Underwood, who has many staunch and influential friends in the trade who will not leave a stone unturned to throw business in his way whenever an opportunity presents itself. It will be remembered that when the system of conduiting buildings first came out, Mr. Underwood was among the first to go before the public. He was then with the Interior Conduit & Insulation Company, New York, coming to Chicago in 1891 as general sales agent for that company. He was also the first person to install an automatic telephone exchange for public use. This was for the Strowger Automatic Telephone Exchange, in November, 1892.

ST. LOUIS NOTES.

ST. LOUIS, MO., May 24, 1897.

HOUSEMAN LINE REORGANIZED.—The St. Louis & Kirkwood Railroad Company was reorganized last week. It proposes to double-track the road during the coming summer, and make a ten-minute service all along the line.

SUIT FOR INFRINGEMENT.—The United States Electric Light Company filed a suit in the United States Circuit Court last Saturday against the International Electric Company, alleging an infringement upon a patent carbon conductor for electric lamps. The court is asked for an accounting and a permanent injunction.

ENGINEERS' CLUB.—Mr. H. A. Wagner, general manager of the Wagner Electric Manufacturing Company, addressed a well-attended meeting of the Engineers' Club one evening last week on "The Electric Lighting System of the City of St. Louis." Mr. Wagner gave a detailed description of the devices and methods used by the different plants.

INCREASED CAPITAL.—A special meeting of the stockholders of the Bell Telephone Company of Missouri, to increase the capital from $400,000 to $2,000,000, will be held July 1. The increased capital is made necessary by the tremendous expense imposed on the company by the underground conduit ordinance, and by extensive improvements made imperative by the organization of a powerful opposition telephone company.

MANDAMUS GRANTED.—The Supreme Court in Chambers has granted an application of the St. Louis Underground Service Company for an alternate writ of mandamus against the Board of Public Improvements, of St. Louis city, to compel that body to act on the application filed February 18, 1897, for a permit to make connections in a certain part of the city. The writ is made returnable to court *en banc* of June 8, 1897, when it will be set for hearing on its merits. A temporary injunction was granted. This suit is instituted as a test to find out if the Underground Service Company has a surety, and to determine whether or not it may be permitted to enjoy its property. Twice has the Supreme Court of the State decided against this company, but it has not given up the fight. The climax was reached when the Bell Telephone Company attempted last week to demolish the manhole of its conduit, which was used by the Postal Telegraph Company. As the Underground Service Company and the Kinloch Company are very friendly, the present fight looks as if it is the beginning of the war between the Bell and Kinloch Companies.

PACIFIC COAST NOTES.

SAN FRANCISCO, Cal., May 15, 1897.

HABIRSHAW WIRES ON THE COAST.—The agency for the Habirshaw wires has been taken by Chas. R. Lloyd, No. 18 Second Street, San Francisco.

TWO-PHASE WORK.—The Commercial Light & Power Company, San Francisco, has closed a contract with the Stanley Electric Manufacturing Company, through John Martin, Pacific Coast agent, for a 300-kw two-phase generator, which will be driven by a McIntosh & Seymour vertical engine.

TELEPHONE CONDUITS.—The Peoples' Mutual Telephone Company, San Francisco, recently broke ground for its extensive system of conduits. Quite a large number of contracts has been obtained, and operations are to be carried on in accordance with the latest practice. J. L. Crittenden is president and manager of the new enterprise.

EIGHTY-ONE MILES AT A PRESSURE OF 33,000 VOLTS.—The Southern California Power Company is expected to let important contracts at Redlands on or after May 29. Up to that date bids will be received for an alternating plant that will transmit current at a pressure of 33,000 volts from the Santa Anna River to Los Angeles, a distance of 81 miles. Henry Fisher, of Pittsburg, Pa., and H. H. Sinclair, are leading stockholders.

ELECTRIC POWER IN A NEWSPAPER OFFICE.—Mr. O. W. Jantz, for ten years superintendent of the Card Electric Company's shops, in Cincinnati, Ohio, is in the city. He superintended the installation of a special type Bullock Electric Manufacturing Company's motor, for direct driving of the "Daily Examiner's" new sextuple color press, capacity 48,000 an hour. The motor is a six-pole compound-wound machine, using 500 volts at normal speed. For slow speeds and in starting the effect of a rotary transformer is obtained, giving a very low voltage to the driving side of the motor.

ENGLISH NOTES.

(From Our Own Correspondent.)

LONDON, May 12, 1897.

BRIGHTON-ROTTINGDEAN SEASHORE ELECTRIC RAILWAY.—This unique and enterprising undertaking, which, as some of your readers may perhaps recollect, received almost its death blow within a week of its opening, will shortly recommence working.

A NEW ENGLISH CHANNEL TELEPHONE CABLE.—On Saturday last the cable steamer "Monarch," after waiting for about a week for fine weather, succeeded in laying the second two-circuit telephone cable across the English Channel, connecting London and Paris. The second pair of circuits on the English side of the cable have been completed for some time, but matters are not so far forward in France. The third two-core cable, which is to be constructed by the French Government, is also behindhand. However, by the middle of the summer, it is hoped that there will be six metallic telephone circuits connecting England and France, and which will enable not only London and Paris, but Liverpool and Marseilles, to be brought within conversational distance of one another.

THE MARCONI SYSTEM OF WIRELESS TELEGRAPHY.—A brief demonstration of the Marconi system of wireless telegraphy was made last week before several of the leading officials of the Eastern Telegraph Company, who, I understand, were much impressed with what they saw. So far as the scientific and technical public is concerned, no more is known of Mr. Marconi's methods than was divulged in a somewhat mysterious manner at the British Association meeting, at Liverpool, last autumn by Mr. Preece. A few weeks hence Mr. Preece is to read a paper before the Royal Institution, and I can hardly doubt that he will give his audience somewhat more solid fare than the public has hitherto been treated to. It would seem almost certain that the chief merit of Mr. Marconi's system is the discovery of a sensitive, reliable and self-recovering "coherer."

THE SERULLAS PROCESS OF GUTTA-PERCHA EXTRACTION.—Some years ago a French chemist, M. Serullas, was sent out to the far East at the instance of the French Government to investigate the existing methods of acquiring gutta percha, with a view of improving upon native processes, and also of ascertaining whether the cultivation of Isonandra Gutta could be expected to meet with reasonable success in any of the French colonies. M. Serullas, on his return, described what seemed at first glance to be a very hopeful process of obtaining gutta percha. Instead of bleeding the tree, or, as the natives more frequently do, cutting it down and destroying the source of gutta percha for ever and a day, M. Serullas collected the leaves and twigs and extracted their juice. Experts both in France and England stated at the time that, although the residue had high insulating properties and presented many physical characteristics of true gutta percha, they did not think it was gutta percha at all, but merely an allied resinous compound. They also stated that they had reason to believe that it would very soon lose its physical characteristics of elasticity, pliability, plasticity and toughness. At any rate, doubts of this character have prevailed with our largest cable manufacturing companies, and they have refused to have anything to do with M. Serullas or his process. The matter has been investigated chemically by Professor Ramsay, of argon fame, and favorable reports have been received from Lord Kelvin and Dr. John Hopkinson, and no doubt in due time a big company will be floated. It must be confessed that it would be far more satisfactory to the investor if the inventor could obtain the favorable opinion of a rubber expert which would be of far greater intrinsic value than the opinions of scientific men, however eminent, who do not profess to have any peculiar acquaintance with the mysteries of gutta percha. I believe the present ruling price of gutta percha in England is about 6s. per pound, and it is estimated by M. Serullas that with a liberal allowance for the cost of reagents, gutta percha can be produced by his process at a cost of not more than 1s. 6d. per pound.

General News.

NEW INCORPORATIONS.

THE CITIZENS' TELEPHONE COMPANY, Dayton, Ohio, has been incorporated by John F. Ohmer, A. B. Ridgway and John Y. Barlow. The company is capitalized at $100,000.

THE BARNESVILLE & WOODSFIELD TELEPHONE COMPANY, Toronto, Ohio, has been incorporated with a capital stock of $10,000, to build and operate a telephone system.

THE VESTA ACCUMULATOR COMPANY, Chicago, Ill., has been incorporated, with a capital stock of $25,000. The incorporators are Randall W. Burns, Leon L. Loehr, J. M. Davidson.

THE NACOGDOCHES & SAN AUGUSTINE TELEPHONE COMPANY, Nacogdoches, Tex., has been incorporated with a capital stock of $2000. S. W. Blount and others are interested.

THE MILLER LIGHT & POWER WORKS has been incorporated at Chicago, Ill., with a capital stock of $15,000. The incorporators are Edward W. Goldschmidt, Leverett Thompson and Arthur D. Wheeler.

THE CLYDE TELEPHONE COMPANY has been incorporated at Columbus, Ohio, with a capital stock of $10,000. The incorporators are Edward L. Barber, J. C. Bolinger, D. E. Fuller, T. P. Dewey and B. F. Jackson.

THE FALLSBURG & MONTICELLO RAILROAD COMPANY, Monticello, N. Y., has filed a certificate of incorporation with the Secretary of State, which is an amendment of its original charter, allowing the company to change the route of the road.

THE MILFORD, HOPKINTON & WESTBORO STREET RAILWAY COMPANY, Milford, Mass., has been formed for the purpose of building an electric road from Milford through Hopkinton and Woodville to Westboro. Capital stock, $120,000.

THE WEST END, MT. WASHINGTON & BANKSVILLE STREET RAILWAY, Pittsburg, Pa., has been organized to operate a road two miles long in Pittsburg. The directors are John C. Reilly, T. S. Bigelow and W. J. Burns. Capital stock, $12,000.

THE EAST LIVERPOOL RAILWAY COMPANY has been organized at East Liverpool, Ohio, for the purpose of constructing an electric railway in towns in Columbiana County. The incorporators are Harrison McGraw, Charles Brooks and Lou M. Snyder. Capital stock, $300,000.

THE SARATOGA LAKE RAILROAD COMPANY has been incorporated at Albany, with a capital stock of $150,000. The directors are Robert B. Smith, of Hackensack, N. J.; S. R. Bertron, Alfred B. Thacher and W. J. Worcester, of New York City; Edwin Woodling, of Cranford, N. J., and others.

THE SENECA TELEPHONE COMPANY, Ovid, N. Y., has filed a certificate of incorporation, with a capital stock of $4450. The directors are John E. Purcell, B. Franklin, George W. Golding, Dr. J. Denniston, John M. Townsend, W. W. Roger, F. C. Allen, Ira C. Hall, T. P. Hause, William White and John C. Sebring.

The Telegraph and Telephone.

DODGEVILLE, WIS.—Arrangements have been completed for the extension of the Dodgeville telephone system, both east and west, from this city.

AVA, ILL.—A company has been organized here to establish a telephone exchange, which, when completed, will connect with various places in this section.

ALLEGAN, MICH.—The Berlamont Telephone Company is building a line from Berlamont to this place, and it is expected that the line will be in working order inside of three weeks.

SPRINGFIELD, ILL.—A bill has been introduced in the Illinois Legislature giving telephone companies the same rights that telegraph companies have in obtaining right of way and in the erection of poles.

FORT WAYNE, IND.—The Home Telephone system in this city was destroyed on May 23 by a fire caused by the crossing of a trolley wire with a telephone wire. Fifteen hundred instruments were affected by the burn-out.

QUINCY, ILL.—The Central Union Telephone Company is extending its lines from Quincy to Keokuk, Ia. The line will run through Fowler, Mendon, Loraine, West Point, Carthage and Hamilton, and will be completed by the middle of June.

FT. SCOTT, KAN.—Mr. Munsell, of Iola, Kan., is interested in a movement to establish a mutual telephone exchange here to connect with the long-distance line which extends from Humboldt to Iola and other places. Various extensions in this vicinity are proposed.

Electric Light and Power.

LOCK HAVEN, PA.—An electric light plant will soon be established in Mill Hall.

CUMBERLAND, MD.—At the election held a few days ago on the question of establishing an electric light plant, the result was in favor of the enterprise. A loan of $20,000 will now be negotiated.

NEW YORK CITY, N. Y.—The New York & Staten Island Electric Company has filed an application with the Town Board of Middletown, S. I., for a franchise to light the streets outside of the village of Edgewater.

BOSTON, MASS.—The Edison Electric Illuminating Company of Boston has 30,000 incandescent lights in the residential Back Bay district. During the past year the company installed the same number of incandescent lamps in the city.

GEORGETOWN, MASS.—Messrs. W. M. Brewster, Harold F. Blake and others are making an effort to secure electric lights for this place. The plan is to make suitable arrangements with the electric light and power company of Haverhill, Mass.

WICHITA, KAN.—The Wichita Gas, Electric Light & Power Company has leased the plant and franchise of the Wichita Electric Railway & Light Company for a period of ten years after June 1, next, and the interests of the two concerns will be conducted under one management.

GREELEY, COL.—The Greeley electric light plant was sold on May 10 under a deed of trust for $5,000. Mr. William Mayher was the purchaser in the interests of the estate of Warren Currier, the Greeley National Bank and the Union Bank. A new company will be organized under the name of the Greeley Power & Light Company, with a capital stock of $17,000. The new company will thoroughly overhaul the plant and put it in first-class order.

PUEBLO, COL.—At the last meeting of the Council of this city it was decided to inquire into the feasibility of constructing a plant of 200 2000-cp arc lights, and with that end in view a committee was appointed to investigate the cost of erecting and operating a plant of such character. The committee desires to receive quotations and literature bearing on the subject from the different makers of electrical and steam apparatus. Mr. W. A. Middlekamp is secretary of the committee.

The Electric Railway.

WAYNE, N. Y.—The Lyons & Sodus Bay Electric Railroad Company has applied for consent to construct and operate a surface railway in this place.

BROOKFIELD, MASS.—It is stated that a company will be formed in North Brookfield to build an electric road from North Brookfield to Brookfield.

WASHINGTON, D. C.—The projected Washington, Woodside & Forest Glen Railroad is assuming substantial shape, and the gentlemen interested in the enterprise authorize the announcement that the line will be in operation by autumn.

PHILADELPHIA, PA.—The stockholders of the East Penn Traction Company have voted to increase the capital stock of the company from $350,000 to $410,000. The company is now operating in Bucks County and intends to extend its lines.

DENVER, COL.—The Florence & Cripple Creek Railway Company is considering the advisability of substituting electric power for the steam locomotives now in operation on its lines. The company also expects to sell electric power in Cripple Creek.

CLEVELAND, OHIO.—It is stated that the Cleveland, Lorain & Wheeling Railroad Company is considering the matter of an electric service in connection with its regular steam service. The officials are now looking into the subject, and it is expected that something definite will be known in the near future. This step has been brought about by the competition of electric lines that parallel the Cleveland, Lorain & Wheeling road at a number of places, and which have taken from it a large proportion of its local passenger traffic.

Personal Notes.

MR. J. ORNE RYDER has severed his connections with the Crown Woven Wire Brush Company, Salem, Mass., and on May 26 his relations with the company as secretary and treasurer ceased.

MR. M. M. HAYDEN, formerly of the National Carbon Company, has been appointed manager of the Globe Carbon Company, Ravenna, Ohio, the reorganization of which was mentioned in last week's issue of The Electrical World. Mr. Hayden has served a long apprenticeship in the carbon business, and it is his intention to vigorously push the business of the Globe Carbon Company. Mr. Charles L. Rodman, formerly manager of the Globe Company, is now connected with the National Carbon Company.

Trade and Industrial Notes.

SATISFACTORY BUSINESS.—The Ball & Wood Company, New York, has every reason to be satisfied with the condition of its business. Its engines are growing in popularity and the demand for them is constantly increasing.

A FAVORABLE PROPOSITION.—Messrs. Frank H. Stewart & Co., Philadelphia, Pa., find a ready sale for the Ward incandescent arc lamps, of which they have a large supply. They are offering these lamps to the trade on terms which should prove very attractive to those desiring this well-known type of lamp.

INCANDESCENT LAMPS FOR THE NAVY.—The Shelby Electric Lamp Company, Shelby, Ohio, has received a large order for incandescent lamps to be furnished for one of the United States gun boats. This order was given after a severe and satisfactory test of a sample lot of lamps sent to Philadelphia.

NEW CATALOGUE.—The General Incandescent Arc Light Co., N. Y., has about completed the preparation of a new catalogue, illustrating and describing the great variety of appliances manufactured by this concern. The catalogue is in press and will be issued very shortly. It is very artistically arranged, and will undoubtedly be very acceptable to many.

REORGANIZED UNDER THE OLD NAME.—The Electrical Specialty Company is the name of a new company which has bought the stock and business of the old company of the same name in Syracuse, N. Y. Mr. J. M. Walshe is manager of the new concern. The new management announces that it is in no way responsible for any debts contracted by the old company prior to April 8, 1897.

THE F. & C. MOTOR SWITCHES make up a new line of goods which the Electric Appliance Company, Chicago, have recently added to its already complete and extensive stock. The F. & C. switches fill the bill for a low-priced motor switch in capacities of 35 and 65 amperes. The Electric Appliance Company will be pleased to send special prices on these goods on application.

AIR-BRAKES IN THE COLONIES.—The Standard Air-Brake Company, New York, has secured an additional order from the colonies for twenty-eight complete air-brake outfits for electric motor and trail cars, and another order for additional motor-car air-brakes. This company's air-brakes have been used in the colonies for nearly three years, and this latest order would indicate that they are giving satisfaction.

"THEY ARE GREAT."—Mr. George Zimmerman, electrical engineer and contractor, Newark, N. J., in a recent letter to I. P. Frink, New York, pays a flattering compliment to the Frink reflectors for lighting stores, offices, show windows, etc. Mr. Zimmerman says that during his experience with these reflectors they have given perfect satisfaction, and that his customers for whom the reflectors have been put up say "they are great."

THREE HUNDRED TONS OF ENGINES.—The St. Louis Iron & Machine Works, St. Louis, Mo., are building two rolling-mill engines for the Pittsburg plant of the Consolidated Steel & Wire Company. One is a tandem compound-condensing Corliss engine of 1800 horse-power, and the other, a cross compound-condensing Corliss engine of 2200 horse-power. This shipment will weigh nearly 300 tons, and will require sixteen cars for its transportation.

A LARGE FOREIGN ORDER.—The Davis & Egan Machine Tool Company, Cincinnati, Ohio, has received orders for $30,000 worth of machines to go to Antwerp, Stockholm and Copenhagen. President Davis is representing the company in Europe. The company's trade in the northwestern portion of the United States shows a general improvement. Its Chicago office has taken some excellent orders during the past two weeks, and its foreign business continues active.

NON-COMBUSTIBLE BUILDING.—The Acme Malleable Iron Works, Buffalo, N. Y., are erecting an absolutely fire-proof building for the storage of their patterns. The building will be constructed of non-combustible material, and the frame work will be of steel, the covering of corrugated iron, and the racks supporting the patterns will also be made of metal. The Berlin Iron Bridge Company, East Berlin, Conn., is furnishing and erecting the steel frame work and covering.

ENGINES FOR ELECTRIC PLANTS.—The Brush Electric Light & Power Company, Galveston, Tex., has placed its order with the Ball Engine Company, Erie, Pa., for a 450-hp horizontal cross compound engine, which is to be direct connected to a Stanley alternating machine. The city of Okolona, Miss., is about to put up a water works and electric light plant. The engine for the electric plant has been awarded to the Ball Engine Company, Erie, Pa.

"GIVE US THE SAME METAL."—The Mitchell Tempered Copper Company, Corry, Pa., producer of pure hardened copper for electrical purposes, is forging ahead, filling orders from all points of the country. Such communications recently received as "Give us the same metal, we are satisfied;" "The 600

bars you shipped us on March 12 were the finest cast bars we have ever seen; inclosed find an order for 600 bars more from same pattern," are particularly gratifying and speak volumes in favor of this company's product.

HEALTHY CONDITION IN THE INDEPENDENT TELEPHONE BUSINESS.—The Standard Telephone & Electric Company, Madison, Wis., reports a very satisfactory condition of business, and within the last ten days has closed orders for several exchange installations. The high-grade character and non-infringing features of the apparatus manufactured by this company undoubtedly accounts for its constantly increasing business, and to meet which it has recently added largely to its factory forces.

CLOSED CIRCUIT BATTERIES.—The new sealed hard rubber portable battery cells, made by the Nungesser Electric Battery Company, Cleveland, Ohio, are in great demand by the manufacturers of motor wagons, etc. The sales of the company's high-voltage closed-circuit batteries to gas engine manufacturers and railway signal companies is reported as large, and the demand for its fan-motor outfits far exceeds the company's expectations. The fan motors, which are said to be efficient machines, are run by special motor batteries.

AN ACTIVE FAN SEASON.—The Central Electric Company, Chicago, states that the fan motor business is opening up with unusual activity. The line of Lundell fan-motor apparatus handled by it has been considerably increased this year, and with the addition of the Wagner ceiling fan motor and the Emerson induction fan motor it claims to have a most complete line of ventilating apparatus. Its 1897 fan-motor catalogue is an unusually fine representation of the printer's art, and it will be sent on application to anyone interested.

ENGINE CONTRACTS.—The East Side Electric Company, Detroit, Mich., owing to an increase in its business, has ordered from the Ball Engine Company, Erie, Pa., a 150-hp engine. The owners of the Claus Spreckels Building, San Francisco, Cal., have recently awarded a contract for three 150-hp vertical cross compound engines, each of which is arranged for direct connection to a 100-kw General Electric direct-connected machine. The engines will be built by the Ball Engine Company, Erie, Pa. This will be one of the largest plants of the city.

REPAIRING ELECTRICAL MACHINERY.—The W. H. Elliott Electric Company, Cleveland, Ohio, general electrical repairer, has lately increased its capacity, the better to handle its growing business. This concern does a thriving trade in the rewinding and building of armatures, refilling and building of commutators, and overhauling of dynamos and motors. Quite an incentive to central stations and others to intrust their repair work to this company's hands lies not only in the price, but as an extra inducement it offers to share the expense of shipping.

THE G. F. BRUNT PORCELAIN WORKS will hereafter be the title under which will be conducted the business formerly carried on by Messrs. Brunt & Thompson, East Liverpool, Ohio. Mr. George F. Brunt, on May 21, bought out the entire interest of his partner, Mr. C. F. Thompson. It is Mr. Brunt's intention to continue the business with a full line of high-grade porcelain electrical specialties. The manufacture of the company's regulating socket will also be continued. Mr. Brunt has done excellent work in the line of hard porcelain, and promises even a better grade in the future. He will also pay special attention to the regulating socket.

SIOUX CORLISS ENGINES IN GOOD DEMAND.—Among the recent shipment and sales of Sioux Corliss engines by the Murray Iron Works Company, Burlington, Ia., are the following: One 200-hp compound, Wallace, Idaho; one 200-hp compound, Albert Lea, Minn.; one 125-hp, Princeton, Mo.; one 50-hp, Kerkhoven, Minn.; one 65-hp, Alden, Minn.; one 75-hp, Canby, Minn.; one 65-hp, Tarkio, Mo.; one 100-hp, Centreville, Ia.; two 100-hp, Mystic, Ia.; one 250-hp, Port Gibson, Miss., and one 125-hp, Pullman Palace Car Company, Chicago. Most of these engines are accompanied with boilers, and the Pullman plant is set up complete with heater, pumps, piping, etc.

MESSRS. PALMER BROTHERS, of the Mianus Electric Company, Mianus, Conn., the well-known manufacturers of telephones, magneto bells, battery fan motors and other electrical specialties, carry on all their manufacturing by the aid of water power. They own the water falls as well as the land on which their factory is built, and as one brother is the electrical engineer and superintendent of the factory, and the other the general sales agent and correspondent, they are under practically no expense, which in a measure accounts for the low prices they are able to quote. The Messrs. Palmer are both competent and painstaking workmen, and are most particular as to the quality of the goods sent out of their establishment. They have both lived in Mianus all their lives, and are so highly respected that their neighbors would do anything for them. Parts of telephones, used by leading independent telephone companies, are turned out by the Mianus Electric Company by the thousand, and the aggregate volume of business transacted by the company is large and constantly increasing.

AN ACTIVE ENGINE BUSINESS.—The Ridgway Dynamo & Engine Company, Ridgway, Pa., has recently received the following orders for its engines: One compound condensing engine, for the Ithaca Street Railway Company, Ithaca, N. Y. (second order); one automatic engine, direct-connected to a 25-kw Thompson-Ryan generator, for the Hart Memorial Library, Troy, N. Y.; one engine for the Southwestern Coal & Improvement Company, Parsons, Kan.; one engine for the Keystone Coal Mining Company, Lawsonham, Pa.; two engines, direct-connected to two 75-kw Thompson-Ryan generators, for the Cambridge Springs Company, Cambridgeboro, Pa.; two engines, direct-connected to two 100-kw generators, for the Metropolitan Theatre, Buffalo, N. Y.; two 250-hp engines for the Berwin-White Coal Mining Company, Osceola Mills, Pa.; one engine, direct-connected to 20-kw generator, for the North Texas Bank Building, Dallas, Tex.; one engine, direct-connected to 8-kw generator, for the Colorado Apartment House, New York, and one 80-kw generator for the American Bridge Company, Chicago, Ill.; also, one 15x16 engine for the Stellston Coal Company; one 13x20 engine, direct-connected to 60-kw generator, for Lester Manufacturing Company, Lestershire, N. Y., and two 100-kw generators for David S. Brown & Co., New York City.

GENERATORS AND ENGINES.—Business with the Ball Engine Co., Erie, Pa., is good, as may be inferred from the following recent shipments: Vulcan Coal Company, Treveskyn, Pa., one 225-hp direct-connected to generator; Queen City Electric Light & Power Company, Clarksville, Tenn., one 125-hp engine; Langhorne Electric Light & Power Company, Langhorne, Pa. (third order), one 200-hp engine; Maxwell House, Nashville, Tenn. (third order), one 125-hp engine direct-connected to dynamo; Rockville Water Works, Rockville, Md., one 80-hp engine; Wilmington Gas Light Company, Wilmington, N. C. (third order), one 300-hp cross compound engine; Pennsylvania Tube Works, Pittsburg, Pa., one 60-hp engine; Seaboard Air Line, Portsmouth, Va., one 70-hp engine direct-connected to dynamo; Apollo Iron & Steel Works, Apollo, Pa. (fourth order), one 150-hp vertical cross compound, direct-connected alternating machine; Kirk's Soap Factory, Chicago, Ill., one 50-hp engine, direct-connected to dynamo; Lexington Hotel, Richmond, Va., one 40-hp engine; Congo Mining Company, Congo, Ohio, one 175-hp engine; Wainwright Brewing Company, Pittsburg, Pa., one 80-hp engine, direct-connected to dynamo; Fox Pressed Steel Company, Pittsburg, Pa., one 100-hp engine, direct-connected to dynamo; F. O. Norton Cement Company, Binnewater, N. Y., one 60-hp engine; Lakewood Hotel & Land Company, Lakewood, N. J., one 165-hp tandem compound engine.

Business Notices.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 67-71 Park Place, New York City.

NEW ENTRANCE TO NEW YORK.—Passengers via Pennsylvania Short Line may arrive at New York at the foot of Twenty-third Street. The Pennsylvania system's new connection between Jersey City and the Metropolis was formally opened on Sunday, May 16, making three entrances into the centre of the city for this route, one at Cortlandt Street, one at Desbrosses Street and the third at Twenty-third Street. Passengers taking any of the through trains leaving Chicago every day over this route have choice of arriving in New York through either entrance. For particulars address H. R. Dering, Assistant General Passenger Agent, No. 248 South Clark Street, Chicago, Ill.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED MAY 18, 1897.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

582,615. ELECTRIC LOCK; H. Bezer, New Rochelle, N. Y. App. filed Oct. 25, 1892. In a lock, the combination of a locking-piece normally held in locking position, means for moving said locking-piece out of locking position, said locking-piece and said means being both pivoted on the same axis and independently movable, and electrically-controlled means for retaining said locking-piece out of locking position.

582,640. MACHINE FOR FORMING ARMATURE COILS; G. A. Grisell, Madison, Wis. App. filed Nov. 16, 1896. In a machine for forming armature coils, a forming part to receive one side of the coil, another forming part to receive the other side of the coil, two forming parts to receive the ends of the coil, the several parts adjustable each with reference to the size of its forming aperture, and each separately adjustable with reference to its position relative to the others.

582,649. ELECTRIC ADVERTISING AND DISPLAY APPARATUS; J. L. Killmer, New York, N. Y. App. filed March 2, 1896. In an advertising and display apparatus, one or more Geissler's tubes bent and having a portion of the symbol or letters of a word different in color from the remainder of the symbol or word.

582,663. ELECTRIC CONTROLLER; W. H. Morgan, Alliance, Ohio. App. filed Nov. 14, 1896. In an electric controller, the combination with a shell or frame of an annular series of coils therein, said coils arranged in two semi-circular sets, the coils at one end of each set being adapted to offer less resistance than the coils at the other end, contact-plates connected to said coils, and a contact or switch arm adapted to be moved over said contact-plates and cut the coils into or out of circuit, two at a time.

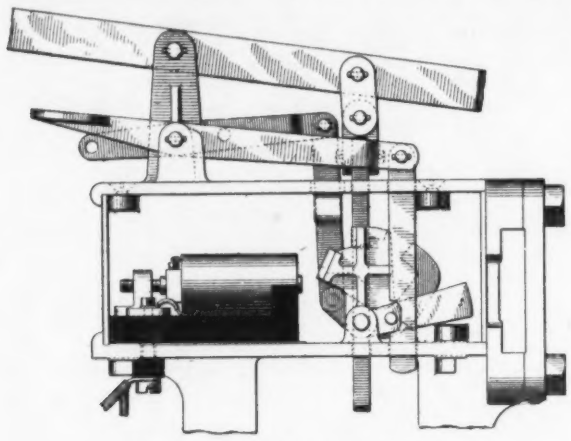
582,664. ELECTRIC ARC LAMP; J. A. Mosher, Chicago, Ill. App. filed Dec. 17, 1892. The combination of an electromagnet, an armature under its influence, but separated therefrom by a non-magnetic block or substance, and a spring connected with and influencing the armature in the same direction as the magnet, all so arranged that when the armature is least influenced by the magnet it is most influenced by the spring.

582,665. ELECTRIC ARC LAMP; J. A. Mosher, Chicago, Ill. App. filed Jan. 19, 1894. In an electric lamp, the combination with the lamp-frame, of a thermo-expansive wire, a clutch carried by the upper carbon rod, a pivoted lever having a tooth adapted to project under one edge of the clutch, said lever being pivotally connected to said wire, one or more springs for lifting the free end of said lever, two fixed supports and an adjustable support for supporting said clutch in a horizontal position independently of the lever.

582,694. ELECTRIC SEARCH LIGHT; S. W. Rushmore, Brooklyn, N. Y. App. filed Jan. 11, 1896. The combination, with a search-light cylinder, of an arc lamp with horizontal carbons in the axis of the cylinder, a spring tending to feed the carbons toward each other, a magnet, an armature pivoted between its poles, a frame carrying a train of gearing and pivoted eccentrically to said armature, carbon-rods engaging respectively with a wheel of said train on opposite sides of the armature pivot, and a suitable detent for the train.

582,698. ELECTRIC RAIL-BOND; G. H. Scott, Worcester, Mass. App. filed July 17, 1896. The combination of rail sections having openings of unequal diameters at different points in their lengths, with an electric bond device comprising a connecting-rod of cylindrical shape at the ends where it fits into said rail-section openings, and two cylindrical-shaped tubes or collars adapted to fit over said cylindrical ends of the connecting-rod and to be driven into the openings in the rails against the beveled surfaces thereof, and thus, by said driving operation, causing a longitudinal compression and lateral expansion of the metal so as to completely fill the openings and form a tight fit therein, said driving operation also causing the connecting-rod to be compressed laterally and its metal forced out longitudinally and expanded.

582,742. GARMENT HOOK; J. J. Horan, New York, N. Y. App. filed July 31, 1896. An apparel-support, comprising a hook pivotally secured to a

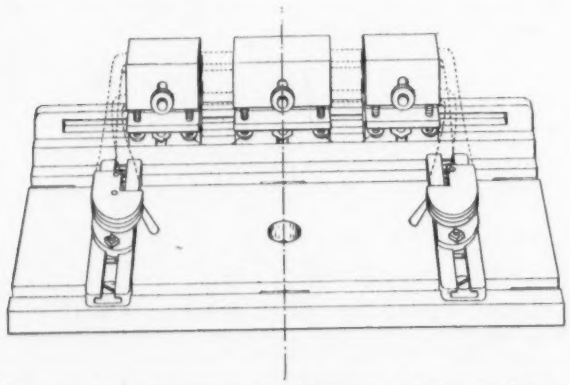


No. 582,615.—Electric Lock.

casing, means in said casing for completing an electric circuit upon the removal of an article from the hook, and means for ceasing the alarm, comprising an insulator adapted to be thrown into engagement by the elevation of the hook, said hook being provided with a heel-piece and toe-piece for operating said circuit.

582,772. METHOD OF AND APPARATUS FOR PREVENTING FORMATION OF ARCS WHEN OPENING CIRCUITS; T. Von Zweigbergk, Cleveland, Ohio. App. filed Oct. 29, 1896. The method of reducing arcing in breaking an electric circuit which consists in establishing a shunt-circuit around the contact to be broken, then breaking the main circuit, then gradually commutating the current through the shunt-circuit, and finally breaking said shunt-circuit.

582,773. TELEPHONY; A. Absterdam, New York, N. Y. App. filed May 27, 1892. As a means for transmitting articulate speech, an open main line subjected to the magnetic influence produced by a constant current in a



No. 582,640.—Machine for Forming Armature Coils.

local line or circuit, and means independent of the local circuit for transmitting speech by originaling variations of magnetical condition corresponding to speech.

582,840. ELECTRIC SWITCH; E. H. Wright, Chicago, Ill. App. filed March 13, 1896. A blade switch, comprising a switchboard, a central-fixed contact member mounted thereon, and provided with two oppositely-extending blades, terminal contact members, each provided with a blade arranged adjacent to and in alignment with one of the blades of said central contact member, movable contact members each comprising a pair of parallel resilient blades secured together at both ends, so as to leave an intervening space, and pivotally connected with a fixed terminal mounted upon the switchboard, said movable members being severally adapted for contact with each of the blades of each pair, means for connecting line wires with each of the several contact terminals, and means for simultaneously shifting said movable members from contact with the blades of the central contact member to those of the terminals adjacent thereto, and vice versa.

582,849. RAIL-BOND; F. H. Daniels, Worcester, Mass. App. filed Feb. 10, 1897. An improved article of manufacture, a flexible rail-bond, comprising a flexible body portion and two terminals or ends made separate from the flexible body portion and secured thereto by pressure to be substantially integral therewith.

582,862. CIRCUIT BREAKER FOR TROLLEY WIRES; C. Hoff, Cincinnati, Ohio. App. filed Jan. 22, 1897. A safety circuit-breaker device or hanger for trolley and other electric wires, composed of a suitable main bar or frame having downwardly-turned forked ends; a pair of contact levers or plates swung in said forked ends toward each other and having their inner flared ends lying normally contiguous and completing circuit within an open socket-frame hung from said main bar; a pair of auxiliary coil springs stretched between the said bar and the inner ends of the contact levers; and a pendent wedge or guide at the centre of the main bar or frame, the said wire being suitably attached or connected to the respective outer-projecting ends of the contact levers, and the whole supported, constructed and adapted to operate automatically.

582,882. TROLLEY FOR ELECTRIC RAILWAYS; S. H. Short, Cleveland, Ohio. App. filed Dec. 22, 1896. In an electric railway, the combination of two conductors, a motor car and a trolley-arm secured thereon by means which cause the upward vertical movement, but prevent lateral movement of the free end thereof, with a horizontal contact roller mounted in the upper end of said trolley-arm, and having the surface at one end which contacts with one conductor insulated from the surface at the other end which contacts with the other conductor, and insulated conductors connecting said respective contact-surfaces with opposite sides of the motor.

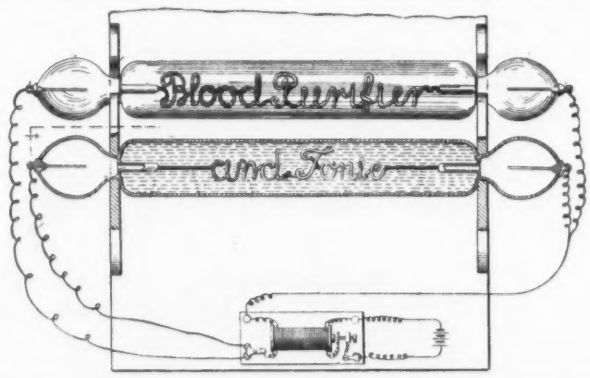
582,883. BRUSH HOLDER; S. H. Short, Cleveland, Ohio. App. filed Jan. 2, 1897. In a brush holder in combination an attached member, a brush-clamping device, a metallic connection between them, and a tension-spring carried by the attaching device, and bearing against an insulated surface upon the clamping device.

582,884. BRUSH HOLDER FOR DYNAMOS OR MOTORS; S. H. Short, Cleveland, Ohio. App. filed Feb. 16, 1897. The combination of the commutator of a dynamo or motor with a radially-adjustable bar, which is parallel with a commutator bar, and has an inclined lower face which is inclined at less than a right angle to a tangent to the commutator at the point of brush contact, and means for holding a brush against said inclined face, and for forcing the brush inward into contact with the commutator surface.

582,901. RECEIVER FOR TELEPHONES, PHONOGRAPHS OR SIMILAR INSTRUMENTS; C. W. Dennis, King's Ferry, N. Y. App. filed Aug. 7, 1896. As a new article of manufacture, a receiver for telephones, phonographs and similar instruments, consisting of a flexible tube adapted to engage the instrument in any desired manner, branches formed from said tube, a hollow rubber ball or bulb in connection therewith, balls or bulbs forming ear-pieces and secured to the outer end of said branches, a short tube having a head at one end thereof secured to said branches, shanks secured on said tubes, and ear-pieces secured on said shanks, and a spring yoke in connection with said ear-pieces and adapted to hold the receiver in position.

582,907. INSULATING FISH PLATE; F. T. Fearey, Newark, N. J. App. filed March 22, 1897. The combination with a fish-plate having a vertical portion with inclined bearings at the upper and lower edges, and having at its lower edge a hollow flaring extension to receive the flange of the rail, of an insulating lining-plate extending over the opposite-inclined bearings and into hollow extensions.

582,910. ELECTRICAL CONDUIT; J. J. Groshans, Buffalo, N. Y. App.



No. 582,649.—Electric Advertising and Display Apparatus.

filed Dec. 5, 1896. A conduit, consisting of two series of pipes one within the other, one series being sealed by a material impervious to moisture, and the other series by a non-conductive material.

582,913. TELEPHONING FROM CARS; M. Garl, Akron, Ohio. App. filed Jan. 10, 1896. In a telephone system, the combination with the line-circuit, of one or more pairs of circuit-controlling springs, located at intermediate points along the line, said springs being normally in contact to complete the circuit, a portable pole provided with arms forming terminals of a circuit and arranged to make contact with terminals located in close proximity with said contact-springs, and to break the circuit formed by the springs when the pole is placed between the latter, and a field telephone connected with wires located within the pole and in connection with the arms.

582,936. ELECTRODE; W. Majert, Falkenberg, Germany. App. filed May 5, 1896. The process of manufacturing electrodes for storage batteries which consists in first applying to the frame of the electrode a coating or filling of a soluble substance, then applying an active mass in contact with said coating, and finally dissolving the soluble coating so as to leave a free space between the active mass and the walls of the frame, whereby the active mass may expand without producing deformation of the frame.